54434

RECORD OF DECISION

NL Industries, Inc.

Pedricktown, Salem County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York
July 1994

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

NL Industries, Inc.

Pedricktown, Salem County, New Jersey

STATEMENT OF BASIS AND PURPOSE

This Record of Decision documents the U.S. Environmental Protection Agency's (EPA's) selection of the remedial action for the NL Industries, Inc. site, in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §9601 et seq. and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. An administrative record for the site, established pursuant to the NCP, 40 CFR 300.800, contains the documents that form the basis for EPA's selection of the remedial action (see Appendix III).

The New Jersey Department of Environmental Protection and Energy has been consulted on the planned remedial action in accordance with CERCLA §121(f), 42 U.S.C. §9621(f), and does not concur with the selected remedy (see Appendix IV).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The remedial action described in this document represents the second of two planned phases, or operable units, at the NL Industries site. This action, designated as Operable Unit One, addresses contaminated ground water, surface water, soils and stream sediments at the site.

A previous Record of Decision, dated September 1991, and subsequent Explanation of Significant Differences, dated March 1992, addressed slag and lead oxide piles, contaminated buildings, structures and debris, and contaminated standing water, all of which were found to be significant and continual sources of contaminant migration from the site. A number of potentially responsible parties are currently implementing this remedy, designated as Operable Unit Two, pursuant to a Unilateral Administrative Order issued by EPA in March 1992. The work associated with Operable Unit Two is nearly complete.

The major components of the selected remedy for Operable Unit One include the following:

- o Excavation of all soils contaminated with lead above the remedial action objective of 500 parts per million (ppm), treatment via solidification/stabilization of those soils classified as hazardous under the Resource Conservation and Recovery Act, and disposal of the treated soils along with non-hazardous soils in a landfill to be constructed on the site (Soil Alternative F).

- o Removal of contaminated stream sediments above 500 ppm of lead from the East Stream and drainage channel north of Route 130 and treatment/disposal of the sediments in a manner similar to that described for soils above (Sediment Alternative B).

- o Extraction and treatment of contaminated ground water with direct discharge of the treated ground water to the Delaware River (Ground-Water Alternative G-2).

- o Appropriate environmental monitoring to ensure the effectiveness of the remedy.

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy meets the requirements for remedial actions set forth in CERCLA §121, 42 U.S.C. §9621: (1) it is protective of human health and the environment; (2) it attains a level or standard of control of the hazardous substances, pollutants and contaminants, which at least attains the legally applicable or relevant and appropriate requirements under federal and state laws; (3) it is cost-effective; (4) it utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable; and (5) it satisfies the statutory preference for remedies that employ treatment to reduce the toxicity, mobility or volume of the hazardous substances, pollutants or contaminants at a site.

Because this remedy will result in CERCLA-hazardous substances remaining on the site above health-based levels, a review pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), will be conducted five years after the commencement of the remedial action to ensure that it continues to provide adequate protection to human health and the environment.

William J. Muszynski

William J. Muszynski, P.E.
Deputy Regional Administrator

7/8/94
Date

RECORD OF DECISION
DECISION SUMMARY

NL Industries, Inc.

Pedricktown, Salem County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York
July 1994

TABLE OF CONTENTS

ATTACHMENTS

SITE NAME, LOCATION AND DESCRIPTION

The NL Industries, Inc. (NL) site is an abandoned, secondary lead smelting facility, situated on 44 acres of land on Pennsgrove-Pedricktown Road, in Pedricktown, Oldmans Township, Salem County, New Jersey. The site is bisected by an active railroad. Approximately 16 acres are located north of the railroad tracks, including a closed 5.6-acre landfill. The southern 28 acres contain the industrial area and landfill access road (Figure 1). NL maintains the landfill area and operates the landfill's leachate collection system. The population of Oldmans Township is approximately 1,700. The site overlies the Cape May Formation, which has been classified as a Class 2A aquifer (potable water source) by the State of New Jersey.

The West and East Streams, parts of which are intermittent tributaries of the Delaware River, border and receive surface runoff from the site. The nearest home is less than 1,000 feet from the site and B.F. Goodrich and the inactive Tomah Division of Exxon are neighboring industrial facilities.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

In 1972, the facility began the operation of recycling lead from spent batteries. The batteries were drained of sulfuric acid, crushed and then processed for lead recovery at the smelting facility. The plastic and rubber waste materials resulting from the battery-crushing operation were disposed of in the on-site landfill, along with slag from the smelting process.

Between 1973 and 1980, the New Jersey Department of Environmental Protection and Energy (NJDEPE) noticed NL with numerous violations of state air and water regulations. Water pollution violations were directed toward the battery storage area and the on-site landfill. NJDEPE conducted an air-monitoring program in 1980 that detected airborne quantities of lead, cadmium, antimony and ferrous sulfate produced by the smelting process, at levels exceeding the facility's operating permits.

NL ceased smelting operations in May 1982. In October 1982, NL entered into an Administrative Consent Order (ACO) with NJDEPE to conduct a remedial program to address contaminated site soils, paved areas, surface water runoff, the on-site landfill and ground water. In December 1982, the site was placed on the National Priorities List (NPL).

In February 1983, the plant was sold to National Smelting of New Jersey (NSNJ) and smelting operations recommenced. NSNJ entered into an amended ACO with NJDEPE, National Smelting and Refining Company, Inc., which was NSNJ's parent company, and NL. The amended ACO clarified the environmental responsibilities of NSNJ and NL. NSNJ ceased operation in January 1984, and filed for bankruptcy in March 1984.

In April 1986, NL entered into an ACO with the United States Environmental Protection Agency (EPA), whereby NL assumed responsibility for conducting a Remedial Investigation and Feasibility Study (RI/FS) for the site with EPA oversight. In June 1991, numerous potentially responsible parties (PRPs) were notified of their potential liability for contamination and response costs associated with the NL site. The RI/FS for Operable Unit One was completed in July 1993.

EPA conducted a multi-phased Removal Action at the site to address several conditions that presented an imminent risk to public health and the environment. EPA conducted Phase I of the Removal Action in March and April 1989. It consisted of construction of a chain-link fence to enclose the former smelting plant and spraying or encapsulation of the on-site slag piles. Encapsulation of the piles provided temporary protection from wind and rain erosion and contaminant migration. In November 1989, EPA began Phase II of the Removal Action. This phase consisted of additional encapsulation of the slag piles, securing the entrances of the contaminated buildings, and removal of over 40,000 pounds of the most toxic and reactive materials.

During March of 1991, EPA performed Phase III of the Removal Action. Damages to the perimeter fence were repaired, a new entrance gate was installed, and all on-site containers stored in open areas were emptied and staged under existing covered areas. Sand/gravel berms were installed around these materials to deter their release. During July of 1992, Phase IV of the Removal Action reinforced the slag bin retaining walls which were in danger of collapsing.

Phase V of the Removal Action, which began in the fall of 1993, is expected to be completed during the spring and summer of 1994. This phase of the Removal Action involves the removal of the most highly contaminated stream sediments from the West Stream, and the elimination of contaminated sediments as a source of contamination to the environment. Sediments excavated thus far have been disposed of off site.

Recognizing the size and complexity of the site, EPA is addressing its remediation in phases, or operable units. Operable Unit Two addressed the slag and lead oxide piles, contaminated surfaces and debris, and contaminated standing water, which were found to be significant and continual sources of contaminant migration from the site. The Operable Unit Two remediation, which is further discussed on the following pages, is nearly complete.

This Record of Decision (ROD) addresses the remediation of the following environmental media which are designated as Operable Unit One: soils; ground water; surface water; and stream sediments. The term "stream sediments," as used throughout this ROD, refers to contaminated sediments located in the East Stream and the drainage channel north of Route 130 (see Figure 1).

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI report, FS report, and the Proposed Plan for the site were released to the public and the PRPs for comment on July 22, 1993. These documents were made available to the public in the administrative record file at the EPA Docket Room in Region II, New York and the information repository at the Penns Grove Public Library and the Oldman's Township Municipal Building. The notice of availability for the above-referenced documents was published in Today's Sunbeam on July 22, 1993. The public comment period on these documents was held from July 22, 1993 to September 19, 1993.

On August 2, 1993, EPA conducted a public meeting at Oldman's Middle School located on Freed Road in Pedricktown, New Jersey, to inform local officials and interested citizens about the Superfund process, to review current and planned remedial activities at the site, and to respond to any questions from area residents and other attendees.

Responses to the comments received at the public meeting and in writing during the public comment period are included in the Responsiveness Summary (see Appendix V).

SCOPE AND ROLE OF THE OPERABLE UNITS

Operable Unit Two

EPA addressed Operable Unit Two on an expedited basis as an Early Remedial Action through a ROD, dated September 1991, and a subsequent Explanation of Significant Differences (ESD), dated March 1992. The ESD provided the option of sending the treated slag off site for disposal. The Early Remedial Action for Operable Unit Two began in November 1992 and was implemented concurrently with the site-wide RI/FS for Operable Unit One.

During the Early Remedial Action, over 10,000 cubic yards of slag, in addition to similar materials, were treated using solidification/stabilization technology. After EPA confirmed that the treatment was effective, the treated slag was sent off site for disposal at a Resource Conservation and Recovery Act (RCRA)-permitted landfill. The lead oxide piles and other lead-bearing materials were sent to a secondary lead smelter for recycling. Concurrently, buildings, paved surfaces, equipment and debris were decontaminated. At this time, all buildings have been dismantled and recycled as scrap metal. Equipment has been reused or recycled as scrap metal. Hazardous wastes have been shipped to RCRA-regulated facilities. Decontaminated concrete has been recycled and used as fill for low-lying areas, such as the basement of the site's former refining building.

Once decontamination and dismantling are nearly complete, the remaining contaminated standing water and water used for decontamination will be collected and transported off site for treatment and disposal. Several hundred thousand gallons of standing water have been shipped off site to prevent flooding during precipitation events. Finally, the industrial area of the site will be regraded, as needed, to prevent further accumulation of water.

Operable Unit One

Operable Unit One addresses soils, ground water, surface water, and stream sediments. A site-wide RI/FS has been performed by NL, in which the RI represents a comprehensive study designed to determine the nature and extent of site-related contamination. The FS identified and evaluated remedial action alternatives to address contaminant sources and eliminate potential long-term health risks.

EPA also conducted a site-specific ecological assessment to determine the ecological effects of contamination at the site. This study was used to help develop the remedial action objectives for the cleanup of the contaminated media.

SUMMARY OF SITE CHARACTERISTICS

Contaminated Soils

Elevated concentrations of metals were found in soils, including lead detected up to 12,700 parts per million (ppm) in soils located within NSNJ property and 1,770 ppm in soils located outside of the property. Although several other metals were detected in site soils, including cadmium and zinc, lead is the most prevalent and is the primary contaminant of concern. Table A shows chemicals of concern in soils.

It is estimated that approximately 30,000 cubic yards of soil are contaminated above the remedial action objective of 500 ppm of lead. Figure 2 shows areas of the site requiring excavation above the 500 ppm cleanup level. Approximately seven acres of contaminated wetlands would require remediation as part of the cleanup. Up to two additional acres of wetlands would be used for placement of the on-site landfill described in the soil alternatives.

During heavy rainfall, water flowing over contaminated soil flows toward the West Stream. Concentrations of lead in the stream were measured as high as 206 parts per billion (ppb) in surface water samples and 23,700 ppm in stream sediment samples. The lead concentrations in the stream exceed the estimated Federal Ambient Water Quality Criteria of 3.2 ppb for the protection of aquatic life based on chronic toxicity.

Contaminated Ground Water

The site is underlain by three hydrogeologic units: the unconfined (uppermost and water table) aquifer; the first confined aquifer; and the second confined aquifer.

Shallow ground water in the unconfined aquifer generally flows in a northwesterly direction, however, discontinuous layers of sands and clays cause localized variations in flow direction. Ground water in the first confined aquifer flows in a westerly direction. Ground water in the second confined aquifer flows in a northeasterly direction, possibly influenced by the pumping of industrial supply wells in the area.

The unconfined aquifer is part of the Cape May Formation and averages approximately 20 feet in thickness. The water level is approximately 5 to 10 feet below the ground surface. The unconfined and first confined aquifer are separated by a clay layer ranging in thickness from about 5 to 20 feet.

The first confined aquifer exists approximately 50 to 70 feet below grade and is part of the Raritan Formation. The second confined aquifer is also part of the Raritan Formation. The first and second confined aquifers are separated by a clay layer of approximately 30 feet in thickness.

A contaminant plume has been detected in the unconfined aquifer below the site. The plume starts at the factory complex and extends in the direction of shallow ground-water flow to the northwest. The plume is comprised primarily of lead and also contains elevated levels of other contaminants. In the shallow zone of the unconfined aquifer (see Figure 3), lead concentrations in the vicinity of the factory complex area ranged from 3,130 ppb to 4,400 ppb, and cadmium concentrations ranged from 6 ppb to 173 ppb. In the deep zone of the unconfined aquifer (see Figure 4), lead and cadmium concentrations ranged from 9 ppb to 56 ppb and from 3 ppb to 997 ppb, respectively. Arsenic was detected in one well in the unconfined aquifer adjacent to the existing landfill at concentrations of up to 4,900 ppb. Other metals detected on the site at elevated levels include beryllium, chromium, copper, nickel and zinc. A localized area of elevated volatile organic compounds was found in the vicinity of two monitoring wells. Volatile compounds detected include 1,1,1 trichloroethane at up to 4,700 ppb, 1,1 dichloroethane at up to 210 ppb, 1,1 dichloroethylene and tetrachloroethene at up to 210 ppb and vinyl chloride at up to 76 ppb.

In addition to the metals and volatile organic compounds discussed above, elevated readings of gross alpha and gross beta radiation were detected in ground water in one localized area of the site during the remedial investigation. Several sampling events during the RI confirmed the elevated radiation levels in the groundwater in this area. A further investigation will be performed to determine if the elevated levels of radiation are attributable to natural or anthropogenic sources. The results of this investigation will be incorporated into the design of the ground-water remediation system as appropriate.

The first and second confined aquifers have not been significantly impacted by contamination from the unconfined aquifer. Lead levels detected in the first confined aquifer ranged from 1 to 3 ppb, except in one well where a level of 12 ppb was detected in 1990. Cadmium was not detected in this aquifer. Only one volatile organic compound, acetone, was detected in one well in the first confined aquifer at a level of 12 ppb. Lead levels detected in the second confined aquifer ranged from 2 to 6 ppb. Arsenic was detected in one well at a level of 2.7 ppb. No cadmium or volatile organic compounds were detected.

Contaminated Surface Water and Stream Sediments

Elevated levels of lead, copper and zinc have been detected in both the surface water and sediments in the East and West Streams, and the drainage channel north of Route 130. Since lead is the most predominant of the contaminants in sediments, EPA believes that by remediating lead-contaminated sediments, copper and zinc contamination will also be reduced to acceptable levels.

Lead detected in the surface waters of the East and West Streams ranged from 10 ppb to 2,200 ppb in 1989 and 4 ppb to 206 ppb in 1990. These levels exceeded EPA's estimated Ambient Surface Water Quality Criteria of 3.2 ppb for the protection of aquatic life based on chronic toxicity (see Figure 5). The highest lead concentrations were found in the West Stream adjacent to the factory complex.

Lead concentrations in stream sediments ranged from 5 ppm to 23,700 ppm (see Figure 6). The highest concentrations were in the West Stream adjacent to the factory complex and decreased through the drainage channel toward the Delaware River. This contamination is currently being addressed under EPA's Phase V Removal Action. EPA believes that the elevated surface water concentrations are primarily caused by the contaminated sediments and soil, and surface runoff from contaminated sources in the factory complex. The major factory complex sources have been addressed under Operable Unit Two. Therefore, after the contaminated sediments and soils are remediated, it is expected that surface water quality will improve to levels which no longer pose an environmental threat.

SUMMARY OF SITE RISKS

EPA conducted a baseline risk assessment to evaluate the potential risks to human health and the environment associated with the NL site in its current state. The Risk Assessment focused on contaminants in the soil and ground water which are likely to pose significant risks to human health and the environment. The summary of the contaminants of concern in soil and ground water sampled is listed in Table A and was used for human health exposure scenarios. The contaminants of concern in soil, sediments and surface water sampled are identified in Tables 1 through 5 and were used for environmental receptor exposure scenarios.

Human Health Risk Assessment

EPA's baseline risk assessment addressed the potential risks to human health by identifying several potential exposure pathways by which the public may be exposed to contaminant releases at the site under current and future land-use conditions. Soil and ground-water exposures were assessed for both potential present and future land-use scenarios. The baseline risk assessment evaluated the health effects which could result from exposure to contamination from soils (ingestion, dermal contact, and inhalation of wind-borne compounds), and ground water (ingestion, inhalation of volatiles while showering, and dermal contact). The risk assessment considered the site's current land use as an abandoned industrial facility, and future land use as either an industrial facility or residential area. Current receptors included off-site residents (child and adult) and off-site workers. Future receptors included on-site residents (child and adult), off-site residents (child and adult), on-site workers, and off-site workers. Ground-water use was only considered for future exposure scenarios. A total of six exposure pathways were evaluated under possible on-site current and future land-use conditions. All of the exposure pathways considered are listed in Table B. The reasonable maximum exposure was evaluated.

Under current EPA guidelines, the likelihood of carcinogenic (cancer-causing) and noncarcinogenic effects due to exposure to site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and noncarcinogenic risks associated with exposures to individual compounds of concern were summed to indicate the potential risks associated with mixtures of potential carcinogens and noncarcinogens, respectively.

Potential carcinogenic risks were evaluated using the cancer slope factors developed by EPA for the contaminants of concern. Cancer slope factors (SFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of [milligrams/kilograms-day (mg/kg-day)]$^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the risk highly unlikely. The SFs for the compounds of concern are presented in Table C.

Several of the contaminants, including arsenic, beryllium, 1,1-dichloroethane, 1,1-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene and vinyl chloride are known to cause cancer in laboratory animals and are suspected to be human carcinogens. For these contaminants, EPA considers excess upper-bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than a one in ten thousand to one in a million additional chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at the site. The results of the quantitative baseline risk assessment indicate that all exposures to receptors under current land use are acceptable in terms of cancer. Under potential future land use, all receptors except the on-site worker, have unacceptable risks for both carcinogenic and noncarcinogenic effects due to ground-water ingestion. In addition, all future residents have unacceptable cancer risk via the inhalation of volatile ground-water contaminants while showering.

The greatest carcinogenic risk accrues to the (hypothetical) future residents (on-site and off-site) through ingestion of ground water. The cancer risk is 2×10^{-3}, meaning that 2 excess cancers per 1,000 residents could occur if future residents were to use the contaminated ground water. As previously indicated, current Federal guidelines for acceptable exposures are a maximum excess carcinogenic risk in the range of 10^{-4} to 10^{-6}.

The cumulative upper-bound cancer risk at the site is 3×10^{-3}. This future hypothetical cancer risk would accrue to both the on-site and off-site adult through both ingesting and inhaling (while showering) volatile contaminants in ground water. Hence, the risks due to exposure to carcinogens at the site are unacceptable as they exceed EPA's acceptable risk range. Calculated carcinogenic and noncarcinogenic risks for the NL site are shown in Table E. The estimated total risk is primarily driven by 1,1 dichloroethylene. These estimates were developed by taking into account various conservative assumptions about the likelihood of a person being exposed to these media.

Noncarcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA to indicate the potential for adverse health effects. RfDs, which are expressed in units of mg/kg-day, are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intake of chemicals from environmental media (*e.g.*, the amount of a chemical ingested from contaminated drinking water) are compared to the RfD to derive the hazard quotient for the contaminant in the particular medium. The HI is obtained by adding the hazard quotients for all compounds across all media that impact a particular receptor population.

An HI greater than 1.0 indicates that the potential exists for noncarcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The reference doses for the compounds of concern at the site are presented in Table D. A summary of the noncarcinogenic risks associated with these chemicals across various exposure pathways is found in Table E.

It can be seen from Table E that the HI for noncarcinogenic effects under potential future land-use for all receptors except the on-site worker are greater than one (unacceptable risk) due to ground-water ingestion. In addition, under the future land use scenario, the on-site child resident had unacceptable risks due to ingesting and dermally contacting contaminated soil, in addition to ingesting ground water. The noncarcinogenic risk was attributable to several compounds including antimony, cadmium, chromium, nickel, and zinc. The receptor at greatest risk of noncarcinogenic effects is the on-site child who would use ground water, with virtually all of the risk attributable to drinking the water. The risk is nearly all attributable to the metal arsenic.

Although EPA has established RfDs and SFs for chemicals evaluated in the baseline risk assessment, lead currently does not have a RfD, SF, or similarly accepted toxicological parameters. Consequently, the risk due to lead cannot be quantified. This is of particular significance at the NL site, since lead is the major contaminant of concern. Therefore, the risks posed by lead have been qualitatively evaluated for site soils, sediment, and ground water. Elevated concentrations of lead have been detected on site in the soils, sediments, surface water and ground water. Exposure to lead has been associated with both human carcinogenic and noncarcinogenic effects. The major adverse effects in humans caused by lead include alterations in red blood cell production and the nervous system. High concentrations in the blood can cause severe irreversible brain damage and possible death. EPA has classified lead as a "B2" carcinogen, which indicates that it is considered a probable human carcinogen.

With regard to all exposure scenarios considered in the baseline risk assessment, where there was a non-acceptable cancer or non-cancer risk, the cumulative cancer risk and hazard indices would be even higher if the effects of lead could be quantitatively included.

Ecological Risk Assessment

Potential risks to the environmental receptors associated with the NL site were identified in the ecological risk assessment. The ecological risk assessment identified robin and woodcock nestlings, red fox and mink as those receptors most threatened by the site contaminants under current site conditions.

A four-step process is utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario: *Problem Formulation* - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. *Exposure Assessment*--a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. *Ecological Effects Assessment*--literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. *Risk Characterization*--measurement or estimation of both current and future adverse effects.

The ecological risk assessment was conducted during 1992 at the site by EPA's Environmental Response Team. It included a study of contaminant uptake by ecological receptors located at the site, as well as bioaccumulation modelling of contaminant uptake by higher organisms and laboratory toxicity testing of sediment. The results of the ecological study and risk assessment were used in developing the remedial action objective for lead contaminated soils. Table 5-b shows the exposure profiles used for the Ecological Risk Assessment.

Two media potentially posing risks to non-human receptors at the NL site are the stream sediments and wetland soils. These media contribute to degradation of surface water quality in the East and West Streams and drainage channel. The contaminants of concern are metals, with lead (Pb) being the most widespread, and detected at much higher levels than other metals. For this reason, a site-specific ecological assessment was performed to determine a risk-based clean-up level for lead only, with the assumption that a clean-up commensurate with a safe level of lead would also result in protective levels of the other metals to the ecological receptors.

Lead from site soils and sediments enters the food chain via absorption and ingestion. Bioavailable soil- and sediment-bound lead is accumulated by specific components of the food chain, such as small mammals, earthworms and frogs. Lead in site soils becomes available to terrestrial fauna (e.g., small mammals) and avian forms when they feed upon earthworms, the latter accumulating body burdens of lead through their deposit-feeding activity. The sediment-borne lead is available for uptake by amphibians (e.g., frogs) that frequent the site's two streams. The concentrations of lead in earthworms and frogs was then utilized in the evaluation of the exposure of lead to organisms which were not directly sampled.

During the field investigation, earthworms were exposed to site soils with lead concentrations in the range of 120-6,900 ppm dry weight of soil. Although lethality as an endpoint was monitored, the bioaccumulated lead in the worm tissues was recorded for use in a modelling exercise to determine whether this posed a toxicological threat to earthworm predators (i.e., robins, and woodcocks). In a similar fashion, green frogs found on site had their tissues analyzed for lead content. This information was modelled for the potential toxicological threat posed to their natural predators native to the site area (the great blue heron, and the mink). Finally, the white-footed mouse was selected as a representative terrestrial species serving as a diet item of the red-tailed hawk, the long-eared owl, the red fox, and the mink.

A hazard quotient approach was utilized to evaluate the likelihood that lead concentrations in site media and animal tissues would produce deleterious effects. In this method, exposure levels are compared to levels which have been shown to cause toxicological effects (i.e., daily lead intake/reference dose = Hazard Quotient). A hazard quotient greater than 1.0 indicates that exposure to contaminants at calculated levels may cause deleterious effects. Hazard quotients calculated in the Ecological Risk Assessment, which are shown in Table 8, suggest that significant risk exists at the site at concentrations above 500 ppm of lead for the following species (and with the following associated toxicological endpoint): robin and woodcock nestlings (reduced brain weight and hematocrit), red fox (anorexia and convulsions), and mink (reduced population).

Solid phase toxicity testing of sediment using the midge *Chironomous tentans* revealed that chronic impacts occurred at a sediment lead concentration of 1,100 ppm. Mortality was also observed during testing of sediment samples containing lower concentrations of lead. However, these results may have been associated with factors other than lead concentration, such as depressed pH.

EPA's Ecological Risk Assessment for the site concluded that, at levels greater than 500 ppm of lead in soils and sediments at the NL site, there is a potential for adverse ecological effects. Although it is also possible that potential risks to ecological receptors exist at concentrations less than 500 ppm of lead in soils and sediments, EPA has determined that a remedial action objective for lead in soils and stream sediments of 500 ppm is adequately protective of ecological receptors.

Uncertainties

The procedures and inputs used to assess risks in the Ecological and Human Health Risk Assessments, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemical sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemical analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the Risk Assessment provides upper-bound estimates of the risks to populations near the site, and is highly unlikely to underestimate actual risks related to the site.

More specific information concerning public health and ecological risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the Risk Assessment Section of the RI Report and in the Ecological Risk Assessment Reports.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in the ROD, may present an imminent and substantial endangerment to the public health, welfare, or the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. They specify the contaminant(s) of concern, the exposure route(s), receptor(s), and acceptable contaminant level(s) for each exposure route. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk-based levels established in the risk assessment.

The following remedial action objectives have been established for the first operable unit at the NL site:

- To leave no greater than 500 ppm of lead remaining in site soils and stream sediments; and

- To restore the contaminated unconfined aquifer to drinking water standards for all contaminants. Established remedial action objectives for each contaminant of concern for ground water are listed in Table F.

In general, EPA has developed health-based cleanup levels for lead in soil based on a model that predicts blood lead levels in the most sensitive populations (children) from exposure to lead-contaminated air, dust, drinking water, soil, and paint. EPA's "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" (OSWER Directive #9355.4-02) recommends using a soil cleanup level within the range of 500-1,000 ppm of lead. However, the remedial action objective for lead in soil and sediment at the NL site was based upon EPA's site-specific ecological assessment, which concluded that 500 ppm of lead is the appropriate remedial action objective for site soils located in ecologically sensitive areas, as well as stream sediments. In addition, EPA will apply this remedial action objective consistently throughout the site to ensure the long-term protection of the ecologically sensitive areas. Therefore, the remedial action objective for lead in soils and sediments of 500 ppm is adequately protective of both ecological and human receptors.

The remedial action objective for lead in ground water is the New Jersey Ground-Water Standard of 5 ppb. However, the New Jersey Practical Quantitation Limit (PQL) for lead is 10 ppb. The PQL is the lowest concentration that can be reliably detected by a laboratory during routine laboratory operating conditions as established by NJDEPE as part of the New Jersey Ground-Water Standards. Therefore, achievement of the objective will be determined by compliance with the PQL. The remedial action objective for cadmium is the New Jersey Ground-Water Standard of 4 ppb. Concentrations detected within the ground water contaminant plume exceed the remedial action objectives for both lead and cadmium, among other contaminants of concern listed in Table F.

DESCRIPTION OF REMEDIAL ALTERNATIVES

The Comprehensive Environmental Response, Compensation and Liability Act, As amended (CERCLA) §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

This ROD evaluates in detail, fourteen remedial alternatives for addressing the contamination detected in various media at the NL site. The term "Months to Achieve Remedial Action Objectives" refers to the amount of time it would take to design, construct and complete the action. "N/A" implies that the "Months to Achieve Remedial Action Objectives" is not applicable for the particular alternative. "O&M Cost" refers to the cost of operation and maintenance during implementation of a particular alternative.

For ground-water alternatives, the term "Months to Construct" refers to the time needed to complete construction of the ground-water treatment system.

The remedial alternatives are:

Soils Alternatives

Soil-A: No Action

Capital Cost:	$149,000
Annual O&M Costs:	$2,000
Total Present Worth Cost:	179,800

Months to Achieve Remedial Action Objective: Remedial Action Objective Not Achieved

Superfund regulations require that a No Action alternative be evaluated at every site to establish a baseline for comparison with other alternatives. The No Action alternative for soils not meeting remedial action objectives would include site access restrictions, such as fencing. In addition, assessments would be performed every five years to determine the need for further actions.

Soil-B: Excavate All Soils above the Remedial Action Objective / Treat All Excavated Soils Using Soil Washing / Landfill Non-Hazardous Soils On Site / Backfill Treated Soil Meeting Remedial Action Objectives

Capital Cost:	$22,084,700
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$22,161,700

Months to Achieve Remedial Action Objective: 42

All soils, including soils in wetland areas and stream sediments, not meeting the remedial action objective would be excavated and treated using soil washing. The soil washing technology may utilize both physical size separation and chemical separation to remove contaminants from the soil. Liquid washing fluids would be recycled into the process and later disposed of off site along with extracted contaminants. Washed soil meeting the remedial action objective would be returned into the excavated areas. Washed soil rendered non-hazardous but not meeting the remedial action objective would be placed in a landfill to be constructed on site. The concentrated waste stream from the soil washing process, including fines and wash fluid, would be treated, and disposed of off site at an appropriate RCRA-permitted facility. Treatability studies would be required to determine if the remedial action objective could be met, and to the determine the optimum operating parameters for the soil washing system. The treated material would require TCLP testing to confirm that the material is non-hazardous.

The objective of this alternative is to treat soils to meet the remedial action objective, and then backfill the soils on the site. In such a case, no five year review would be required since all remaining soils would be non-hazardous and below health-based levels. However, if any treated soils above the remedial action objective remain on site in a landfill, then this alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), because implementing it would result in CERCLA hazardous substances remaining on site above health-based levels. Additional remedial actions could be required depending on the results of such a review.

The on-site landfill to be constructed to contain non-hazardous soils contaminated above the remedial action objective would include a liner underlying the landfill as well as a geomembrane cap. The base of the landfill would be built up with clean fill as necessary to raise the level above the 100-year flood plain. Six inches of gravel would be placed over the geomembrane cover as a drainage layer. Approximately 30 inches of soil would be placed and seeded over the drainage layer.

Soil-C: Excavate All Soils above the Remedial Action Objective / Treat All Excavated Soils Using Solidification / Stabilization / Landfill Treated Material On Site

Capital Cost:	$13,306,400
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$13,383,400

Months to Achieve Remedial Action Objective:	24

All soils and stream sediments not meeting the remedial action objective would be excavated, treated on site by solidification/stabilization (S/S), and landfilled on site. The landfill would be comparable to the landfill described under Alternative B. This technology immobilizes contaminants by binding them into an insoluble matrix. Stabilizing agents such as cement, pozzolan, silicates and/or proprietary polymers would be mixed with the feed material. The equipment is similar to that used for cement mixing and handling. Bench-scale tests would be required to select a number of design parameters including the type of binder, proper ratio of stabilizing agents, feed material, and water. Depending on the specific treatment process, the volume of stabilized material may increase up to 50 percent of the original volume. The treated material would require TCLP testing to confirm that the material is non-hazardous. Excess treated material which can not be landfilled on site due to space limitations would be transported and disposed of off site in an appropriate RCRA-permitted facility.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), because it would result in CERCLA hazardous substances remaining on site above health-based levels. Additional remedial actions could be required depending on the results of such a review.

Soil-D: Excavate All Soils above the Remedial Action Objective / Soil Wash Hazardous Soils / Landfill Non-Hazardous Soils On Site / Backfill Treated Soil Meeting Remedial Action Objectives

Capital Cost:	$10,635,500
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$10,712,500

Months to Achieve Remedial Action Objective: 36

All soils not meeting the remedial action objective would be excavated. Excavated soils and stream sediments which are non-hazardous would be landfilled on site. The landfill would be comparable to the landfill described under Alternative B. Excavated soils and sediments which are classified as hazardous waste would be treated using soil washing as described under Alternative B, above. Treated soils meeting the remedial action objective would be returned into excavated areas. Treated, non-hazardous soils that do not meet the remedial action objective would be landfilled on site along with the untreated excavated non-hazardous soils. Secondary wastes, such as fines from the soil washing process, would be treated and disposed of off site at an appropriate RCRA-permitted facility.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), since it would result in CERCLA hazardous substances remaining on site above health-based levels. Additional remedial actions could be required depending on the results of such a review.

Soil-E: Excavate All Soils above the Remedial Action Objective / Landfill Non-Hazardous Soils On Site / Solidification/Stabilization of Hazardous Soils / Dispose Treated Soil Off Site

Capital Cost:	$10,344,900
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$10,421,900

Months to Achieve Remedial Action Objective: 24

Under this alternative, soils not meeting the remedial action objective would be excavated. Excavated soils and stream sediments which are non-hazardous would be landfilled on site. The landfill would be comparable to the landfill described under Alternative B. Excavated soils and stream sediments which are classified as hazardous would be treated on site using S/S as described in Alternative C. The solidified/stabilized soils would then be disposed of off site at an appropriate RCRA-permitted facility.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), since it would result in CERCLA hazardous substances remaining on site above health-based levels. Additional remedial actions could be required depending on the results of such a review.

Soil-F: Excavate All Soils Above the Remedial Action Objective / Solidification / Stabilization of Hazardous Soils / Landfill Non-Hazardous Soils On Site

Capital Cost:	$6,403,350
Annual O&M Costs:	$5,000
Total Present Worth Cost:	$6,480,350

Months to Achieve Remedial Action Objective: 24

Under this alternative, soils not meeting the remedial action objective would be excavated. Excavated soils and stream sediments which are non-hazardous would be landfilled on site. The landfill would be comparable to the landfill described under Alternative B. Excavated soils and stream sediments which are classified as hazardous would be treated on site using S/S as described in Alternative C. The solidified/stabilized soils would then be landfilled on site along with the excavated non-hazardous soil.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), since it would result in CERCLA hazardous substances remaining on site above health-based levels contained in the on-site landfill. Additional remedial actions could be required depending on the results of such a review.

Soil-G: Excavate All Soils above the Remedial Action Objective/Dispose Off-Site

Capital Cost:	$15,840,200
Annual O&M Costs:	N/A
Total Present Worth Cost:	$15,840,200

Months to Achieve Remedial Action Objective: 24

All soils not meeting the remedial action objective would be excavated. Based on sampling, hazardous and non-hazardous soils would be segregated. All soil and stream sediments would be transported off site to an appropriate, permitted facility for treatment and disposal based on soil characteristics. It is expected that some soils classified as RCRA hazardous waste will be treated off site, in compliance with all RCRA requirements, prior to disposal. The most likely treatment for this material is S/S.

Ground-Water Alternatives

Below is a description of Ground-Water Alternatives A, B, E, F and G. Alternatives C and D are discussed in the FS Report. They include treatment and reinjection of ground water through leach fields and infiltration trenches. It is estimated that 30 acres of leach fields and 20 acres of infiltration trenches would be required to implement Alternatives C and D, respectively. These alternatives are not discussed in this ROD as they are not feasible to construct due to the extensive land requirements.

Ground Water-A: No Action

Capital Cost:	$10,000
Annual O&M Costs:	$3,245
Total Present Worth Cost:	$60,000
Months to Construct Remedy:	N/A

Superfund regulations require that a No Action alternative be evaluated at every site to establish a baseline for comparison with other alternatives. The No Action alternative for ground water not meeting remedial action objectives would include institutional controls and water use restrictions. This alternative would leave contaminants above health-based cleanup levels on site unaddressed. Assessments would be performed every five years to determine the need for further actions.

Ground Water-B: Pump and Treat with Subsurface Discharge via an Infiltration Pond

Capital Cost:	$3,889,000
Annual O&M Costs:	$523,285
Total Present Worth Cost:	$11,933,000
Months to Construct Remedy:	30-36

This alternative would consist of pumping and treating contaminated ground water on site from the unconfined aquifer. The pumping system may include components of, or modifications to, the existing well point system located on site for the extraction of ground water, which is comprised of 49 well points, or extraction wells. The treatment process may include precipitation, clarification, filtration and, if necessary, ion exchange or ion replacement. In addition, a reverse osmosis unit would be necessary to treat the level of total dissolved solids (TDS) to the NJ Ground-Water Standard of 500 ppm. Organic contaminants would be removed by air stripping. Residual wastes, including sludges, generated during the treatment process, would be disposed of off site at an appropriate RCRA-permitted facility. Figure 7 shows a schematic diagram of the ground water extraction and treatment system.

The treatment system would be designed to reduce contaminant concentrations to meet federal and state discharge standards for ground water and to restore the aquifer to meet ground-water ARARs (see Table F). Treatability studies would be required to define the design and operating criteria to meet the required standards for ground-water recharge. Treated water would be discharged to the unconfined aquifer through the construction of a 10-acre infiltration pond.

Ground Water-E: Pump and Treat with Subsurface Discharge via Reinjection Wells to the Unconfined Aquifer

Capital Cost:	$3,731,000
Annual O&M Costs:	$539,055
Total Present Worth Cost:	$12,017,000

Months to Construct Remedy:	30-36

This alternative would consist of pumping and treating contaminated ground water on site from the unconfined aquifer. The ground-water extraction and treatment process would be similar to that described in Alternative B. Treated water would be discharged to the unconfined aquifer through upgradient reinjection wells. Problems identified with this alternative include the potential for ground-water mounding which could impact existing structures (such as the existing landfill) and the lack of required land upgradient of the site for reinjection wells. Further hydrogeologic evaluation would be required prior to implementing this alternative.

Ground Water-F: Pump and Treat with Subsurface Discharge via Reinjection Wells to the Confined Aquifer

Capital Cost:	$3,663,000
Annual O&M Costs:	$509,725
Total Present Worth Cost:	$11,498,000

Months to Construct Remedy:	24-36

This alternative would consist of pumping and treating contaminated ground water on site from the unconfined aquifer. The ground-water extraction and treatment process would be the same as that described for Alternative B. Treated water would be discharged to the confined aquifer through reinjection wells. Since the confined aquifer has not been significantly impacted by site contamination, more stringent requirements than the New Jersey Ground-Water Quality Standards might have to be met to prevent degradation of the aquifer. Discharge criteria would be established under the Anti-Degradation Criteria established in the New Jersey Ground Water Quality Standards (N.J.A.C 7:9-6.8), if determined to be applicable. It is expected that the treatment system described in Alternative B, above, could be designed to meet the anti-degradation criteria.

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Ground Water-G: Pump and Treat with Direct Discharge to Surface Water

	Stream	Delaware
Capital Cost:	$3,741,000	$3,525,000
Annual O&M Costs:	$510,785	$427,245
Total Present Worth Cost:	$11,592,000	$10,093,000
Months to Construct Remedy:		36-54

Under Alternative G, two sub-alternatives (G-1 and G-2) were developed. Both of these alternatives would consist of pumping and treating contaminated ground water on site from the unconfined aquifer and discharge of the treated ground water to a surface water body. The ground-water extraction and treatment process would be similar to that described for Alternative B.

G-1: Surface Water Discharge to the East or West Stream: Lead discharge standards to these surface water bodies would be lower than the remedial action objective for lead of 5 ppb associated with ground water quality criteria. The discharge criteria for lead would be the daily maximum effluent New Jersey Pollution Discharge Elimination System permit equivalent of 3.0 ppb. For discharge to either the East or West Streams, a discharge standard of 500 ppm for TDS would apply. Treated water would be discharged to the East or West Stream through a discharge pipe. The treatment system would be similar to that described for Alternative B. Table G1 shows permit equivalent standards for all contaminants identified in the ground water for discharge to the East or West Stream. The permit equivalent standards are those standards which are determined to be protective of the specific surface water body and potential receptors.

G-2: Surface Water Discharge to the Delaware River: The Delaware River is located approximately 1.5 miles to the northwest of the site. Since discharge to the Delaware River would constitute an off-site discharge, a New Jersey Pollution Discharge Elimination System (NJPDES) permit would be required. Table G2 shows estimated discharge criteria for some contaminants identified in the ground water for discharge to the Delaware River. The NJDEPE would develop specific surface water discharge criteria under its permitting authority for all contaminants and appropriate parameters. Based on a preliminary analysis, it is not expected that reverse osmosis treatment would be required to meet requirements for TDS under the terms of a NJPDES permit. Therefore, a reverse osmosis unit may not be a necessary treatment component for this alternative. All other components of the treatment system described in Alternative B would be utilized to meet discharge criteria to be established by NJDEPE for discharge to the Delaware River. For this option, treated ground water would be transported via a pipeline from the treatment plant located on site to the Delaware River. Appropriate access agreements and permits for the pipeline would be obtained. These would include permits for the pipeline to cross under the rail road and Route 130, through private property, and through the U.S. Army

Corps of Engineers dredge spoil area (which lies between Route 130 and the Delaware River). Recent efforts made to obtain the agreements are described in the Documentation of Significant Changes Section.

Sediments

Sediment contamination related to the NL site extends to the East Stream, the West Stream and the drainage channel north of Route 130. The most highly contaminated stream sediments have been detected in the West Stream and are currently being addressed under Phase V of EPA's Removal Action. The alternatives described below address sediment contamination in the East Stream and drainage channel north of Route 130.

Sediments-A: No Action

Capital Cost:	N/A
Annual O&M Costs:	$13,580
Total Present Worth Cost:	$209,000

Months to Achieve Remedial Action Objective: 3

Superfund regulations require that a No Action alternative be evaluated at every site to establish a baseline for comparison with other alternatives. The No Action alternative for sediments not meeting the remedial response objective would include site access restrictions, such as fencing, along with monitoring of surface water quality in the East Stream and drainage channel north of Route 130. In addition, assessments would be performed every five years to determine the need for further actions.

Sediments-B: Sediment Excavation

Capital Cost:	$2,148,200
Annual O&M Costs:	N/A
Total Present Worth Cost:	$2,148,200

Months to Achieve Remedial Action Objective: 18

Under this alternative, additional sampling would be performed to define sediment areas with contaminant concentrations above the remedial action objective. Sediments not meeting the remedial action objective in the East Stream and drainage channel north of Route 130 to the Delaware River would be excavated. Sediments would be managed, to the extent practicable, in accordance with the selected soil alternative. Remediation of the stream and drainage channel would be accomplished by excavation and dredging. Most of the dredging could be accomplished from access adjacent to the stream and channel.

However, some of the dredging in wide areas of the stream and drainage channel may require a barge-mounted excavation device. Sediments would need to be dewatered prior to handling for treatment and disposal with soils. It is estimated that up to 7,900 cubic yards of sediments would be excavated.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting a remedy, EPA considered the factors set out in CERCLA §121, 42 U.S.C. §9621, by conducting a detailed analysis of the viable remedial alternatives pursuant to the NCP, 40 CFR §300.430(e)(9) and OSWER Directive 9355.3-01. The detailed analysis consisted of an assessment of the individual alternatives against each of nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

The following "threshold" criteria must be satisfied by any alternative in order to be eligible for selection:

1. *Overall protection of human health and the environment* addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with ARARs* addresses whether or not a remedy would meet all of the applicable, or relevant and appropriate requirements of federal and state environmental statutes and requirements or provides grounds for invoking a waiver.

The following "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between alternatives:

3. *Long-term effectiveness and permanence* refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

4. *Reduction of toxicity, mobility, or volume via treatment* refers to a remedial technology's expected ability to reduce the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants at the site.

5. *Short-term effectiveness* addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be

posed during the construction and implementation periods until cleanup goals are achieved.

6. *Implementability* refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed.

7. *Cost* includes estimated capital and operation and maintenance costs, and the present-worth costs.

The following "modifying" criteria are considered fully after the formal public comment period on the Proposed Plan is complete:

8. *State acceptance* indicates whether, based on its review of the RI/FS and the Proposed Plan, the State supports, opposes, and/or has identified any reservations with the preferred alternative.

9. *Community acceptance* refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Factors of community acceptance to be discussed include support, reservation, and opposition by the community.

A comparative analysis of the remedial alternatives based upon the evaluation criteria noted above follows.

COMPARISON OF ALTERNATIVES

No Action

Soil Alternative-A, No Action, would not provide protection of public health or the environment over the long or short term. Contaminants would remain in their present state, with little or no reduction in toxicity, mobility or volume. Soil Alternative-A would not achieve the remedial goal of addressing soils which have lead concentrations greater than 500 ppm. Potential long-term risks due to exposure to and migration of contaminants would remain. Although the No Action alternative is the simplest to implement from a technical standpoint, it would not achieve protection of human health and the environment.

Ground-Water Alternative-A, the No Action alternative, would not provide protection of public health or the environment. Contaminated ground water would remain in its present state, with little or no reduction in toxicity, mobility or volume, and may spread over a wider area. This alternative would not meet the remedial action objective for ground water of 5 ppb of lead. In addition, remedial action objectives would not be met for other contaminants which threaten public health and the environment. These are listed in Table F, ground water standards. Potential long-term risks due to exposure to and migration of contaminants would remain. Although the No Action alternative for ground water is the simplest to implement from a technical standpoint, it would not achieve protection of human health and the environment.

Sediment Alternative-A, No Action for sediments in the East Stream and drainage channel, would not provide protection of public health or the environment in the long or short term. Contaminated sediments would remain in their present state, with little or no reduction in toxicity, mobility or volume, and may spread over a wider area. The No Action alternative would not meet the remedial action objective of 500 ppm of lead for sediments. Further, these sediments would continue to contribute to the degradation of surface water quality. Therefore, surface water would continue to exceed state and federal Ambient Water Quality Standards for lead. Potential long-term risks due to exposure to and migration of contaminants would remain. Although the No Action Alternative is the simplest to implement from a technical standpoint, it would not achieve protection of human health and the environment.

Since the No Action alternatives for soil, ground water and sediments would not be protective of human health and the environment, meet remedial action objectives, be effective in the long or short term, or reduce toxicity, mobility or volume of contaminants, they have been eliminated from further consideration.

SOILS

Overall Protection of Human Health and Environment: Soil Alternatives B, C, D, E, F and G would all be protective of human health and the environment. Each of the alternatives would eliminate the exposure pathway of contaminants to human and ecological receptors and the transport mechanisms of contaminants into the environment. Each of the alternatives uses treatment alone, or a combination of both treatment and containment of soils contaminated above the remedial action objective to protect human health and the environment.

Compliance with Applicable or Relevant and Appropriate Requirements: Soil Alternatives B, C, D, E, F and G could all be implemented in compliance with ARARs. ARARs of concern include those which apply to wetland areas including The Clean Water Act (Section 404), The Coastal Zone Management Act, New Jersey Freshwater Wetlands Regulations, and Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands), in addition to RCRA regulations dealing with the identification, handling, transport, treatment and disposal of hazardous waste. Approximately one-third of site soils which exceed the remedial response objective for lead are classified as RCRA characteristic waste. Alternatives B and D include soil washing as a principal component. Treated soils would be sampled to determine that the remedial action objective has been met, prior to returning the treated soil to the site. In addition, the leachability of treated soil would be tested to determine if the waste is RCRA characteristic. Any waste that is found to be RCRA characteristic waste would require further treatment prior to placement either on or off site. Alternatives C, E and F include S/S as a primary element. Solidified/stabilized soils and sediments would be sampled to determine that the material is not RCRA characteristic waste prior to placement of the material either on or off site. Under Alternative G, all soil and stream sediments would be transported off site to an appropriate RCRA-regulated facility for treatment and disposal based on soil characteristics. All soils would be treated and disposed of in compliance with all RCRA requirements. The most likely treatment for this material is S/S.

Since remediation under all of the alternatives, except the No Action alternative, involves excavation and disturbance of approximately seven acres of wetlands (with up to two additional acres of wetlands used for the construction of the proposed landfill), mitigation of impacts to wetlands will be required under all alternatives. A list of identified ARARs may be found in Table H of this ROD.

Long-term Effectiveness and Permanence: Alternative B has the highest degree of permanence of all the alternatives and includes soil washing as a principal element for treating soils above the remedial action objective. Soil washing employs extraction agents and includes soil excavation, above-ground treatment, isolation, removal and consolidation of contaminants and redeposition of cleaned soils. Alternative D employs soil washing as a principal element, but would only treat soils classified as hazardous waste. Other soils above the remedial action objective would be contained on site without treatment. Alternatives C, E and F employ S/S to encapsulate contaminants within the soil matrix, rendering them immobile. All these alternatives are expected to have a high degree of permanence. Alternative G includes excavation of contaminated soil from the site and transportation of this material off site for treatment (as appropriate) and disposal at an appropriate RCRA-permitted facility. Alternatives B and D have a somewhat higher degree of permanence than Alternatives C, E, F, and G since contaminants are permanently removed from the soil. Alternatives B, C, D, E and F would all result in contaminants which have been rendered non-hazardous remaining on site in a landfill. Appropriate monitoring and maintenance of the landfill would be performed to assure that the contaminants remain immobilized over time. All alternatives except Alternative G would be subject to a five-year review on a long-term basis. However, with all these alternatives, the contaminants remaining on site would either be immobilized through S/S treatment (Alternatives C (both hazardous and non-hazardous soils), E and F (only hazardous soils)), or contained without treatment in an on-site landfill (non-hazardous soils under Alternatives D, E and F).

Reduction of Toxicity, Mobility, or Volume Through Treatment: Alternatives B and D would reduce the toxicity, mobility and volume of contaminants through soil washing treatment by permanently removing the contaminants from all or some of the contaminated soil. The soil washing process may generate some secondary waste requiring off-site treatment and disposal. Alternatives C, E and F include S/S as a component. S/S involves the mixing of binding agents and/or stabilizers with the contaminated soils to lock the waste within the binder material matrix, or convert it into a more chemically stable form. The long-term stability of the treated waste would need to be evaluated over time to assure the protectiveness of the treatment. Alternatives C, E and F would reduce the mobility of soil contaminants through treatment, but would increase the volume of contaminated material by up to 50 percent. Alternative G includes the excavation and off-site disposal of all soils above the remedial action objective. Under this alternative, soil classified as RCRA hazardous waste would be treated (most likely by S/S) off site prior to disposal. Soil classified as non-hazardous would not require treatment prior to disposal. Therefore, Alternative G would only reduce the toxicity of some of the waste through off-site treatment, and is comparable under this criteria to Alternatives E and F.

Short-term Effectiveness: Alternatives B, C, D, E and F contain on-site treatment elements and could be implemented with minimal disruption to the surrounding community and the environment. Short-term impacts to the community would involve use of local roads for remedial activities, including transporting materials off site for disposal. Only Alternative F may not require any off-site transport, however, this alternative does allow for materials to be treated and disposed of off site. Alternative G would involve the most transport of materials off the site. Alternative E provides for the off-site disposal of all hazardous material after treatment by S/S. Alternatives B and D would involve transportation for off-site disposal of secondary process waste. Transport of soil off site would be via truck or rail. Rail transport would require replacing the rail spur which had connected the NL facility to an operating railroad. Rail transport may cause less short-term disruption than transport via truck. All soil alternatives are expected to take between two and three and one-half years to complete.

Implementability: Alternative G is the easiest alternative to implement using standard excavation and transportation techniques. Both rail and truck transportation are available. Soil Alternatives B, C, D, E and F are more complicated since, in addition to the use of standard excavation techniques, on-site treatment would also be implemented. Technology and contractors for the soil washing and S/S treatment systems, included in Alternatives B, C, D, E and F, are available. However, treatability studies would be required for both the soil washing and, to a lesser extent, S/S technology to determine operating parameters of the systems. These parameters may vary based upon the soil's physical and chemical characteristics. For soil washing, a treatability study would need to be performed to determine the efficiency which could be attained as well as the type of washing solution, optimum reaction time, potential methods of regeneration and treatment of generated waste water.

Soil washing is an innovative technology whose design parameters include the contaminant concentration, percent fines in the soil, organic content, and pH. Although soil washing has not been fully implemented to treat lead contaminated soils from a battery recycling site such as NL, recent advances show that this technology may be successful at this site in rendering the soil non-hazardous, especially if the process combines size separation with an acid extraction (leaching) step. Residuals of soil washing would require treatment prior to disposal. Residuals would include the wash solution and the soil fines.

A less extensive treatability study for the S/S technology would be necessary to determine the appropriate binding agent to be used and the optimal amount of binder for the contaminated soil characteristics. S/S technology is readily implementable and a considerably simpler process than soil washing. It was used successfully at the site for Operable Unit Two in rendering approximately 10,000 cubic yards of contaminated slag non-hazardous. Soil Alternatives E and G would utilize more off-site disposal space than the other alternatives, which may make the alternatives less implementable at the time of disposal based on landfill space limitations and costs.

The landfilling and capping component included for (treated and untreated) non-hazardous soils above the remedial action objectives in Alternatives D, E and F could be implemented using standard construction techniques.

Cost: Total present worth value costs range from $6,480,350 for Soil-F to $22,161,700 for Soil-B. Alternative G transports all soil off site for treatment and disposal, thus having higher transportation and disposal costs, compared to higher treatment costs for the other soil alternatives. Alternative B, which would treat all soils above the remedial action objective and use treated soils achieving the remedial action objective as backfill, is desirable because it would minimize that amount of land required for creating a landfill, and minimize the quantity of new soil imported to the site for backfill. However, the cost of this remedy is significantly higher than other alternatives. Alternative D is less costly than Alternative B while still retaining the benefits of soil washing and a reduction in the volume of soil to be landfilled. Alternative F is the least costly alternative that achieves the remedial action objective and provides protection of human health and the environment.

GROUND WATER

Overall Protection of Human Health and Environment: Ground-Water Alternatives B, E, F, G-1 and G-2 would all be protective of human health by restoring the unconfined aquifer to drinking water standards. However, Alternative B would create an artificial water body containing lead concentrations greater than ambient surface water quality criteria and therefore, may not be protective of the environmental receptors. Alternatives B, E and F would treat water to drinking water standards and Alternatives G-1 and G-2 would be protective of the environment by treating ground water to the appropriate ambient surface water criteria prior to discharge to the on-site streams or the Delaware River, respectively.

Compliance with Applicable or Relevant and Appropriate Requirements: All alternatives except Alternative A, No Action, would comply with ARARs. Primary ARARs of concern include the Federal and State Safe Drinking Water Act MCLs, the New Jersey Ground Water Quality Standards (and the associated Practical Quantitation Limits), New

Jersey Surface Water Quality Standards, and Federal Ambient Water Quality Criteria as contained in the Toxic Rule, 40 CFR §131.36. For Alternative F, the Anti-Degradation Criteria established in the New Jersey Ground Water Quality Standards (N.J.A.C 7:9-6.8) would be complied with, if determined to be applicable. For Alternatives G-1 and G-2, the treatment system would be designed to meet all substantive NJPDES permit requirements. Since Alternative G-2 includes the discharge of treated ground water off site, a NJPDES permit for surface water discharge, which specifies discharge criteria for the Delaware River, would be obtained. In addition, if the pipeline would be constructed through a wetland area, the wetland ARARs discussed under the soil and sediment sections would be applicable.

The treatment system included for all alternatives, except Alterative A, No Action, could be designed to achieve compliance with chemical-specific ARARs for the discharge either to the confined aquifer, the unconfined aquifer, the on-site streams, or the Delaware River at the estimated costs presented in the FS and summarized in this ROD. Surface-water discharge standards are stringent, especially for Alternative G-1, discharge to the East or West Stream. If upon operation of the treatment system, it is determined that the established discharge requirements cannot be achieved with available technology, ARARs may be waived pursuant to the statutory waiver provisions of Section 121(d) of CERCLA, based on the technical impracticability of achieving discharge criteria. In such a case, alternate discharge limits will be developed by EPA in conjunction with NJDEPE.

Long-term Effectiveness and Permanence: All alternatives except for Alternative A would be designed to treat the ground water to meet remedial action objectives and permanently reduce the magnitude of residual risk. Alternatives B, E and F would be designed to treat water to ground-water standards while Alternatives G-1 and G-2 would be designed to treat to appropriate surface-water standards.

Reduction of Toxicity, Mobility or Volume Through Treatment: All alternatives except Alternative A would permanently reduce the toxicity, mobility and volume of contamination in the unconfined aquifer through treatment technologies employed in the remedy. The treatment technology for each alternative may include precipitation, clarification, filtration, ion exchange and reverse osmosis (except for Alternatives A and G-2).

Short-term Effectiveness: All alternatives, except Alternative A, No Action, would take approximately the same time to complete construction and be implemented. Containment of the contaminant plume may be achieved within approximately 1 to 3 years of operation for Alternatives B, E, F and G. In general, however, restoring an aquifer to remedial action objectives may require treatment and operation in the order of 30 years.

Implementability: Alternative B would be the most difficult to implement because it requires the acquisition of 10 acres of land off site to place the infiltration pond. In addition, Alternatives B and E may be difficult to implement due to potential for mounding in the unconfined aquifer due to the high water table and low transmissivity of the aquifer.

Mounding may lead to a negative impact to existing structures in the vicinity of the site (such as the landfill), as well as the existing on-site landfill. Alternatives B, E, F, G-1 and G-2 would require similar treatment technology that are readily available and can be constructed on site. All of these alternatives, except Alternative G-2, would require a reverse osmosis unit to remove TDS in the effluent stream. The reverse osmosis unit, which removes dissolved solids from the treated ground water, requires significant maintenance to ensure efficient and reliable operation, and also adds considerable cost to the remedy.

The system for surface discharge associated with Alternative G-1 would be easier to construct and maintain than the reinjection components of Alternatives E and F, since reinjection systems are more prone to malfunction due to clogging. For Alternative G-2, a reverse osmosis unit would probably not be required, making the treatment system more reliable and less expensive to operate. A pipeline would be constructed from the site, approximately 1.5 miles to the Delaware River to transport and discharge treated ground water. The pipeline could be constructed using standard construction techniques. Information received during the public comment period and included in the responsiveness summary indicates that appropriate access agreements could be obtained prior to construction. The discharge pipe would also have to cross underneath the on-site, active rail road tracks and Route 130, which may require additional access agreements and permits from state and local authorities, as well as private parties. Finally, discharge to the Delaware River may require additional sampling in order to establish discharge limits for each contaminant under a NJPDES permit.

Cost: Except for the No Action alternative, all of the ground-water alternatives would utilize treatment systems that are similar in design, and all alternatives are within 20 percent of each other in costs. The alternatives differ from each other primarily in the method of discharging treated ground water and the level of treatment needed to meet established discharge standards. All alternatives which include reverse osmosis in the treatment system (Alternatives B, E, F, and G-1) require higher operation and maintenance costs for the same time duration than the alternatives not requiring such a unit (Alternatives A and G-2).

STREAM SEDIMENTS

Overall Protection of Human Health and Environment:

Only Alternative B provides adequate protection of human health and the environment. Human health and environmental risks posed through each exposure pathway are eliminated by removing the contaminated sediments from the environment at levels above the remedial action objective.

Compliance with Applicable or Relevant and Appropriate Requirements:

Alternative B could be performed in accordance with ARARs and would meet the remedial action objective. The primary ARARs of concern are those which apply to wetland areas including The Clean Water Act (Section 404), The Coastal Zone Management Act, New Jersey Freshwater Wetlands Regulations, and Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands), in addition to RCRA regulations dealing with the identification, handling, transport, treatment and disposal of hazardous waste. Sediments contribute to the contamination of surface water in the streams and drainage channel. Contamination in surface water is currently above the Federal Ambient Water Quality Criteria and New Jersey Surface Water Quality Standards. Alternative B would address the remediation of surface water to below these standards through removal of the sediments above the remedial action objective, which are a source of surface-water contamination.

Long-term Effectiveness and Permanence

Alternative A provides neither long-term effectiveness nor permanence. Alternative B would permanently eliminate risks posed by contaminated sediments through the excavation and disposal of contaminated sediments above the remedial action objective. In conjunction with remediation of surrounding site soils, this alternative would maintain reliable protection of human health and the environment after remedial action objectives have been met.

Reduction of Toxicity, Mobility, or Volume Through Treatment:

Alternative A does not reduce the toxicity, mobility or volume of contamination through treatment. For Alternative B, reduction of toxicity, mobility and volume would depend upon the selected soil alternative since sediments above 500 ppm of lead would be treated, to the degree possible, in the same manner as the soils.

Short-term Effectiveness:

Alternative B would be effective in the short term and would quickly achieve the remedial action objective. However, normal water flow in the East Stream and drainage channel would be disrupted during remediation. In addition, procedures would need to be implemented to minimize the resuspension and control of contaminated sediment during remediation. Alternative A, No Action, is not applicable to this criterion since no remedial action would be implemented.

Implementability:

Alternative A, No Action, is most easily implemented as it involves a minimal amount of work. Alternative B would require significantly more planning and site work than

Alternative A, but is still readily implementable. Alternative B utilizes standard construction techniques for the excavation of sediments. Engineering controls would be required to prevent further contamination while sediments are being excavated.

Cost:

Alternative A is estimated to cost $209,000. Alternative B is estimated to cost $2,148,200 to remediate the contaminated East Stream and drainage channel sediments to the remedial action objective. Note that the cost of treatment and disposal of excavated sediments are included in the cost of the soil alternatives.

State Acceptance:

The State of New Jersey has evaluated the selected remedy and does not concur. NJDEPE's basis for not concurring with the selected remedy is discussed in a letter included in Appendix IV of this ROD.

Community Acceptance:

The public strongly supported EPA taking remedial action at the NL site. They supported both the ground water and sediment portions of the preferred alternative. They did not object to the soil treatment process itself. However, they did express a preference for the treatment of all soil above the remedial action objective (Soil Alternative-B), rather than the preferred alternative (Soil Alternative-F), which includes treatment of the hazardous portion and on-site landfilling of the non-hazardous portion of the soil.

SELECTED REMEDY

After reviewing the alternatives and public comments, EPA has selected Soil Alternative F, Ground-Water Alternative G-2, and Sediment Alternative B as the components of the remedy for the site. This combination of alternatives best satisfies the requirements of CERCLA §121, 42 U.S.C. §9621, and the NCP's nine alternative evaluation criteria, 40 CFR §300.430(e)(9).

The major components of the selected remedy are as follows:

Soil-F: Excavate All Soils above the Remedial Action Objective / Solidify/Stabilize Hazardous Soils / Landfill Non-Hazardous Soils On Site

All soils not meeting the remedial action objective will be excavated. Excavated soils and stream sediments which are found to be non-hazardous will be landfilled on site. Excavated soils and sediments which are classified as hazardous waste will be treated using solidification/stabilization technology and also placed in the on-site landfill. It is estimated that approximately 12,500 cubic yards out of a total volume of excavated soil and stream sediment of 42,000 cubic yards, will be classified as hazardous and will be treated. Excavated areas will be backfilled with clean soil and regraded. Wetland areas will be mitigated and restored as appropriate. Based on currently available information, EPA has determined that it is protective of human health and the environment, as well as cost effective, to dispose of treated and untreated soils in a landfill to be constructed at the NL site. The cost estimates presented in the FS, FS addendum, and this document assume that treatment and disposal would occur on the site.

Solidification/Stabilization technology immobilizes contaminants by binding them into an insoluble matrix. Stabilizing agents such as cement, pozzolan, silicates and/or proprietary polymers will be mixed with the feed material. The equipment is similar to that used for cement mixing and handling. Bench-scale tests will be performed to select the proper quantity of stabilizing agents, feed material, and water. Depending on the specific treatment process, the stabilized volume may increase up to 50 percent of the original volume. The stabilized material will be tested by TCLP to confirm that the material is non-hazardous according to RCRA characteristics. Disposal of the treated material would occur on site in accordance with RCRA treatment standards. Any material from which contaminants would leach above acceptable RCRA regulatory levels, as determined by TCLP testing, would be disposed of off site at an appropriate RCRA-permitted facility. However, it is expected that all of the material would meet RCRA regulatory levels after treatment.

The on-site landfill to be constructed to contain non-hazardous soils contaminated above the remedial action objective will include an underlying liner as well as a geomembrane cap. The base of the landfill will be built up with clean fill to raise the level above the 100-year flood plain. Six inches of gravel will be placed over the geomembrane cover as a drainage layer. The precise components of the landfill system will be determined during design. Approximately 30 inches of soil will be placed and seeded over the drainage layer. Construction of the landfill would use up to two acres of wetlands, which would require mitigation. The proposed landfill will be constructed adjacent to the existing on-site landfill.

Ground Water-G-2: Pump and Treat with Direct Discharge to the Delaware River

Alternative G-2 will consist of pumping and treating contaminated ground water on site from the unconfined aquifer and discharging treated ground water to the Delaware River. The pumping system may include components of, or modifications to, the existing well point system located on site for the extraction of ground water. This well point system is comprised of 49 well points, or extraction wells. The treatment process may include precipitation, clarification, filtration and, if necessary, ion exchange or ion replacement and may be augmented during design. However, it is unlikely that a reverse osmosis unit would be necessary to reduce the level of TDS in the treatment plant effluent. Organic contaminants will be removed by air stripping. Residual wastes, including sludges, generated during the treatment process would be disposed of off site at an appropriate

RCRA-permitted facility. Treatability studies will be required to define the design and operating criteria of the treatment system, and to ensure that discharge criteria will be met.

For cost estimating purposes, it was estimated that the system would pump and treat approximately 250 gallons per minute and would operate 30 years.

Sediments-B: Sediment Excavation

Sediments not meeting the remedial action objective in the East Stream and drainage channel north of Route 130 to the Delaware River will be excavated. Sediments will be managed, to the extent practicable, in accordance with the selected soil alternative. Remediation of the stream and drainage channel will be accomplished by excavation and dredging. Most of the dredging could be accomplished from access adjacent to the streams and channel. However, some of the dredging in wide areas of the stream may require a barge-mounted excavation device. Sediments will need to be dewatered prior to handling for treatment and disposal with soils. It is estimated that up to 7,900 cubic yards of sediments will be excavated.

Wetland Considerations

As part of the selected remedy, all appropriate measures will be taken to avoid and minimize any detrimental or adverse impacts upon wetland areas. Approximately seven acres of wetlands will be impacted as a result of contaminant remediation, and up to two additional acres of wetlands will be used to construct the on-site landfill for non-hazardous soils and sediments. There may be additional wetland impacts as a result of the construction of the discharge pipe to the Delaware River. All anticipated wetland losses as a result of this remedial action will be quantified prior to commencement of the remedial action. A wetland mitigation and restoration plan will be developed and implemented to offset wetland losses as a result of this remedial action. This plan will provide for long-term monitoring to assess the success of the remedy with regard to wetland restoration. In addition, the remedial action must comply with the requirements of the Coastal Zone Management Act (CZMA). The CZMA requires that a consistency assessment be performed to assure that the remedial action is consistent with the New Jersey Coastal Zone Management Plan.

STATUTORY DETERMINATIONS

As previously noted, CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, or contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a degree of cleanup that satisfies ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

For the reasons discussed below, EPA has determined that the selected remedy meets the requirements of CERCLA §121, 42 U.S.C. §9621:

Protection of Human Health and the Environment

Soil Alternative-F will be protective of human health and the environment through employing a combination of soil treatment and the engineering controls provided by an on-site landfill. The exposure of receptors to contaminated soils and sediments through inhalation, ingestion and migration will be reduced. Although the risk posed by lead to human receptors can not be quantified, the selected remedy is consistent within EPA's risk based guidance established for Superfund sites, which specifies a cleanup range of 500-1,000 ppm of lead in soils as protective of human health. EPA's determination of a cleanup level of lead in soils and sediments of 500 ppm was based upon the site-specific ecological risk assessment, and will provide an acceptable level of protectiveness to both human and ecological receptors at the site.

Ground-Water Alternative G-2 will be protective of human health and the environment by extracting contaminated water and treating it to surface water discharge criteria to be established for the Delaware River, which are protective of the environment. This remedy will restore the contaminated ground water to drinking water standards which are protective of human health.

Sediment Alternative-B will provide adequate protection of human health and the environment by removing contaminated sediments from the East stream and drainage channel. These sediments will be treated and handled with the excavated soils. The exposure of receptors to contaminated materials through inhalation and ingestion, and contaminant migration will be reduced. The selected remedy will remove contaminated sediments above 500 ppm of lead. The site-specific ecological assessment indicated that a cleanup level of 500 ppm of lead in sediments would be protective of environmental receptors. In addition, implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts.

Compliance with ARARs

The selected remedy is expected to comply with all federal and state, chemical-specific, action-specific, and location-specific ARARs identified in the FS Report. ARARs regarding the soil and sediment portions of the selected remedy include The Clean Water Act (Section 404), The Coastal Zone Management Act, New Jersey Freshwater Wetlands Regulations, Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands), in addition to RCRA regulations dealing with the identification, handling, transport, treatment and disposal of hazardous waste. The ground-water portion of the selected remedy is conceptually designed to achieve drinking water standards and to be in compliance with the standards established for the Delaware River to be protective of surface water bodies. Discharge standards would be specified in a NJPDES permit to be issued by the State of New Jersey. It is expected that the selected remedy will meet all location-specific and chemical-specific ARARs for discharge to the Delaware River and ground water standards. The selected remedy will comply with all ARARs to the maximum extent practicable. However, if the treatment system cannot comply with these limitations, alternate limitations will be developed by EPA.

Cost-Effectiveness

Each component of the selected remedy provides overall effectiveness proportionate to its costs and is therefore cost-effective. Soil Alternative-F will satisfy all statutory requirements, including the preference for treatment, in a cost-effective manner. Ground-Water Alternative G-2 will effectively satisfy statutory requirements in a cost-effective manner by treating contaminated ground water and discharging it to the Delaware River. It will be protective of both ground water and surface water bodies and their respective receptors. Sediment Alternative-B, which removes contaminated sediment from the streams and drainage channel, will also achieve statutory requirements in a cost effective manner.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. Soil Alternative-F includes S/S, which is a proven and widely used technology which will permanently reduce the mobility of contamination in site soils and sediments. The ground-water treatment system included in Ground-Water Alternative G-2 employs a series of treatment components which will permanently reduce contamination in site ground water. The selected remedy provides the best balance of tradeoffs among the alternatives with respect to the evaluation criteria, particularly regarding long-term effectiveness, reduction of toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost.

Preference for Treatment as a Principal Element

In keeping with the statutory preference for treatment as a principal element of the remedy, the remedy provides for the treatment of all hazardous, contaminated soils and sediments at the site. By treating the hazardous portion of the contaminated soils and sediments which pose the primary threat at the site, rendering them nonhazardous, and landfilling the treated soils and sediments along with the remaining contaminated soil and sediments, all exposure pathways will be eliminated. Contaminated ground water will be treated and will also satisfy the preference for treatment as a principal element.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan was released for public comment in July 1993. It identified the preferred alternative as: Soil Alternative-D, which provides for the excavation of all soils above the remedial action objective of 500 ppm of lead, soil washing of all hazardous soils, landfilling and capping of non-hazardous soils, and backfilling treated soils meeting remedial action objectives on site; Sediment Alternative-B, which provides for the removal of contaminated stream sediments above 500 ppm of lead and for the remediation of contaminated sediments in the East Stream and drainage channel north of Route 130; and, Ground-Water Alternative G-1, which includes the extraction and treatment of contaminated ground water with direct discharge of treated ground water to the East or West Stream.

EPA had chosen soil washing as the preferred alternative presented in the Proposed Plan. However, based upon comments received during the public meeting and public comment period, EPA has reevaluated the alternatives considered in the Proposed Plan for contaminated site soils and sediments. Many of these comments dealt with the implementability and cost of the proposed remedy. Based upon the reevaluation of the proposed remedy and consideration of the comments received, EPA is selecting the solidification/stabilization technology (Soil Alternative-F), instead of the soil washing technology (Soil Alternative-D), for the treatment of contaminated soils and sediments.

Soil washing provides the benefit of permanently removing contaminants from the contaminated soil matrix. However, EPA recognizes that in order to implement a soil washing remedy, an extensive treatability study would be required. Comprehensive sampling would also be required to further define the characteristics and distribution of contaminated soil. This effort may be time consuming and costly. In addition, if the treatability study indicated that soil washing would not be successful at the site, then EPA would need to select an alternative treatment technology.

Solidification/stabilization is a process which physically and chemically binds contaminants into an immobile matrix. Although S/S may increase the volume of treated soil and sediment, and thus may increase the size of the on-site landfill to be constructed, EPA agrees that S/S is a proven treatment process for rendering lead-contaminated soils non-hazardous, and it is more easily implemented than soil washing. In fact, it was used as part of the earlier remedial action at this site to treat lead-contaminated slag. EPA anticipates that the treatment of soils and sediments by the S/S technology could be completed at least one year sooner than soil washing, while providing protectiveness of human health and the environment and greater short-term effectiveness than soil washing. Costs presented in the Proposed Plan indicate that S/S will be less expensive to implement than soil washing.

Therefore, EPA has selected S/S as the remedy for contaminated soils and sediments because it would be readily implementable, has a high probability of success, and is a cost-effective method of achieving the remedial action objectives. As part of the selected remedy, the treatment and disposal of the soil and sediment would be performed on site.

As discussed in the Proposed Plan, EPA agrees that both Ground-Water Alternative G-2 (discharge of treated ground water to the Delaware River), as well as Alternative G-1 (discharge of treated ground water to the East or West Streams) would be equally protective of human health and the environment. Alternatives G-1 and G-2 would require similar and available treatment technology and can be constructed on site. However, it is likely that Alternative G-1 would require a reverse osmosis unit to remove total dissolved solids from the treatment plant effluent prior to its discharge, while Alternative G-2 probably would not. Reverse osmosis units tend to require a significant amount of maintenance to operate reliably and are expensive to run.

The system for surface discharge associated with Alternative G-1 would be easier to construct and maintain than the discharge system for Alternative G-2, which would require a pipeline to be constructed from the site approximately one and one-half miles to the Delaware River to transport and discharge treated ground water. The pipeline could be constructed using standard construction techniques and would traverse off-site property between the site and the Delaware River.

In the Proposed Plan, EPA stated that there was uncertainty with respect to procuring the appropriate access agreements prior to construction. The planned discharge pipe would cross underneath rail road tracks (between the plant area and the landfill) and Route 130, which may require additional access agreements and permits from state and local government, and private parties. Construction of such a pipeline in marshy areas and wetlands may be difficult to implement.

Written comments submitted to EPA during the public comment period included letters from private property owners whose right-of-way would be required to build the pipeline to the Delaware River under Alternative G-2. EPA has reviewed these letters which indicate that the necessary land-owning parties have no objection to entering into negotiations for the granting of an easement to construct the pipeline. In addition, B.F. Goodrich, a neighboring facility, recently constructed its own discharge pipeline under

Route 130 and through the U.S. Army Corp of Engineers Dredge Spoils to the Delaware River.

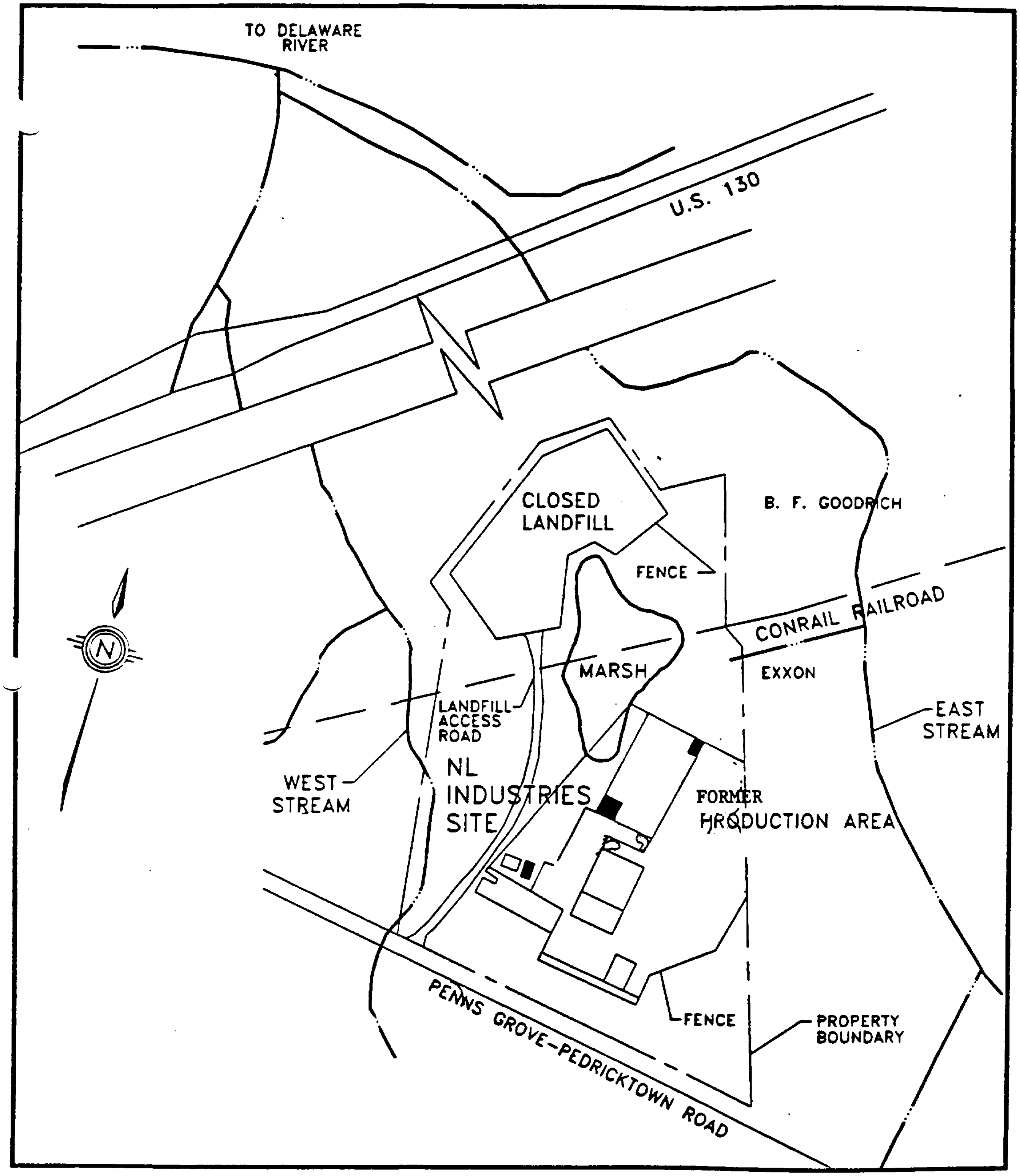
Therefore, currently available information indicates that discharge of treated ground water to the Delaware River described in the Proposed Plan (Alternative G-2) may be more easily implementable than discharge to the on-site streams (Alternative G-1). Since the treatment plant required for Alternative G-2 would be more reliable and economical to operate than that required for Alternative G-1 (because discharge to the Delaware River is not likely to require a reverse osmosis unit to reduce TDS in the effluent), EPA has chosen Alternative G-2, discharge of treated ground water to the Delaware River, as the selected remedy for ground water.

Other than the soil treatment and ground-water discharge changes described above, all other aspects of the Proposed Plan remain the same in the selected remedy.

APPENDIX I

FIGURES

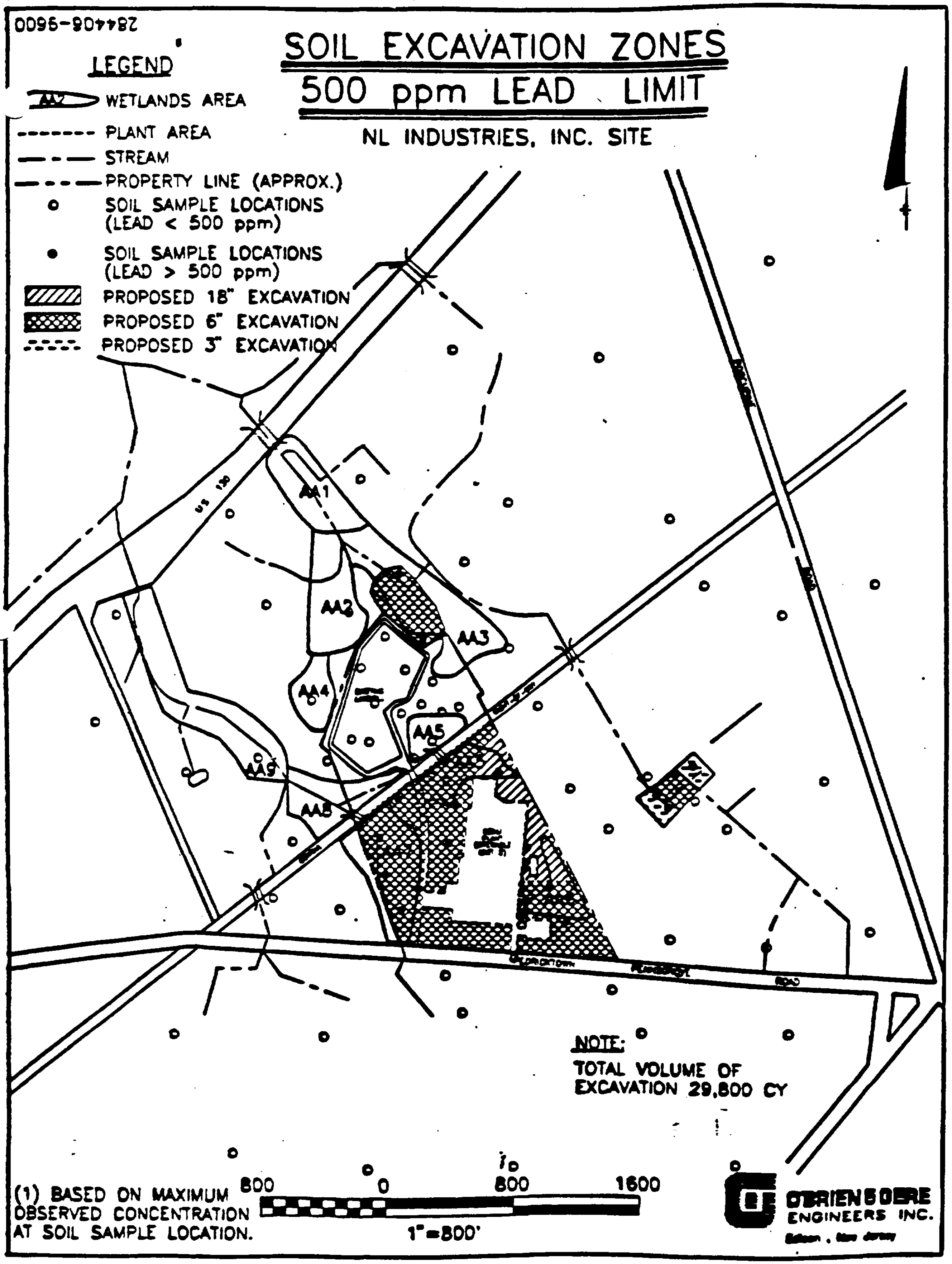
FIGURE 1



N.L. INDUSTRIES SITE LOCATION
NOT TO SCALE

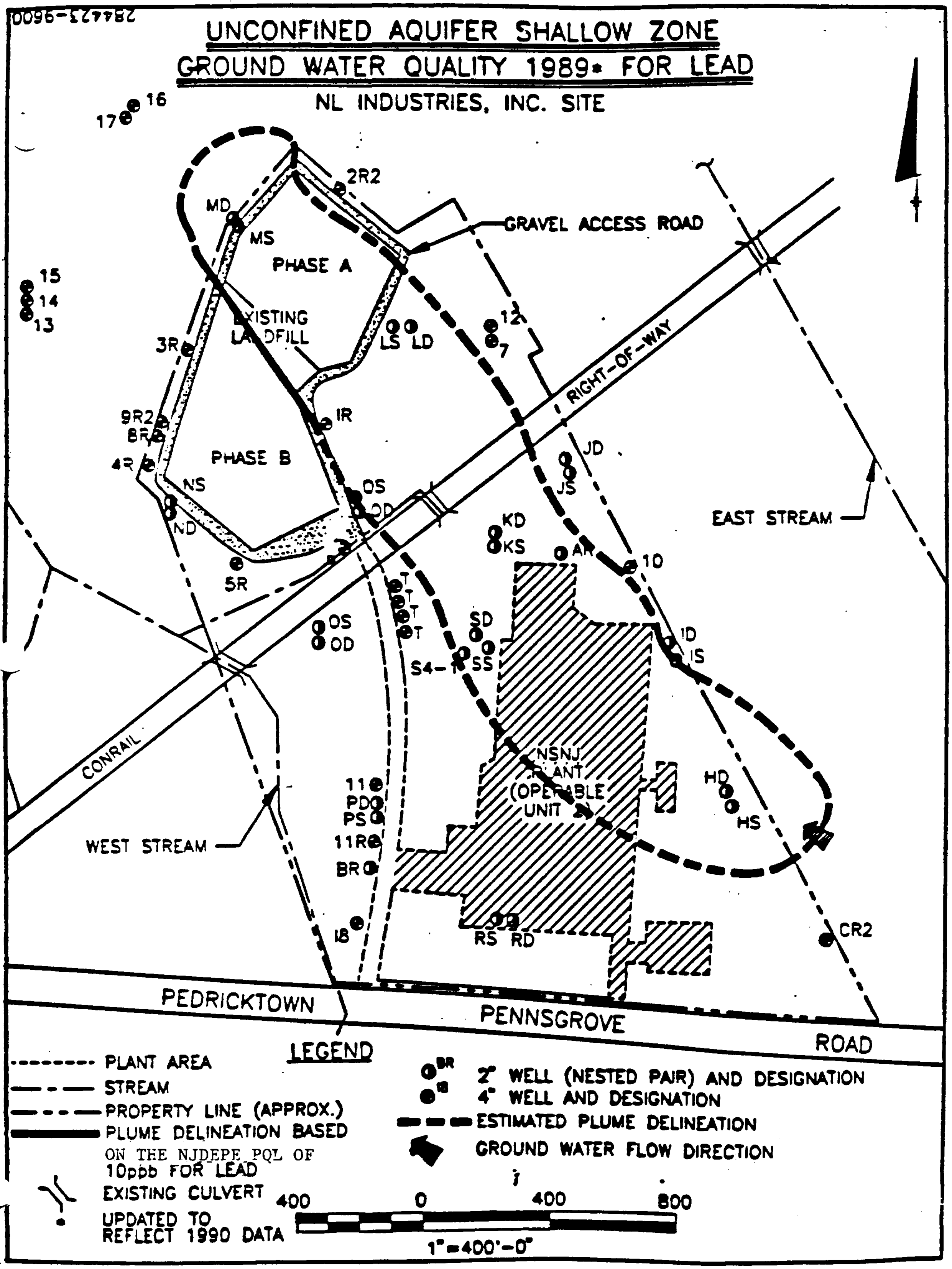
NL1 002 2245

FIGURE 2

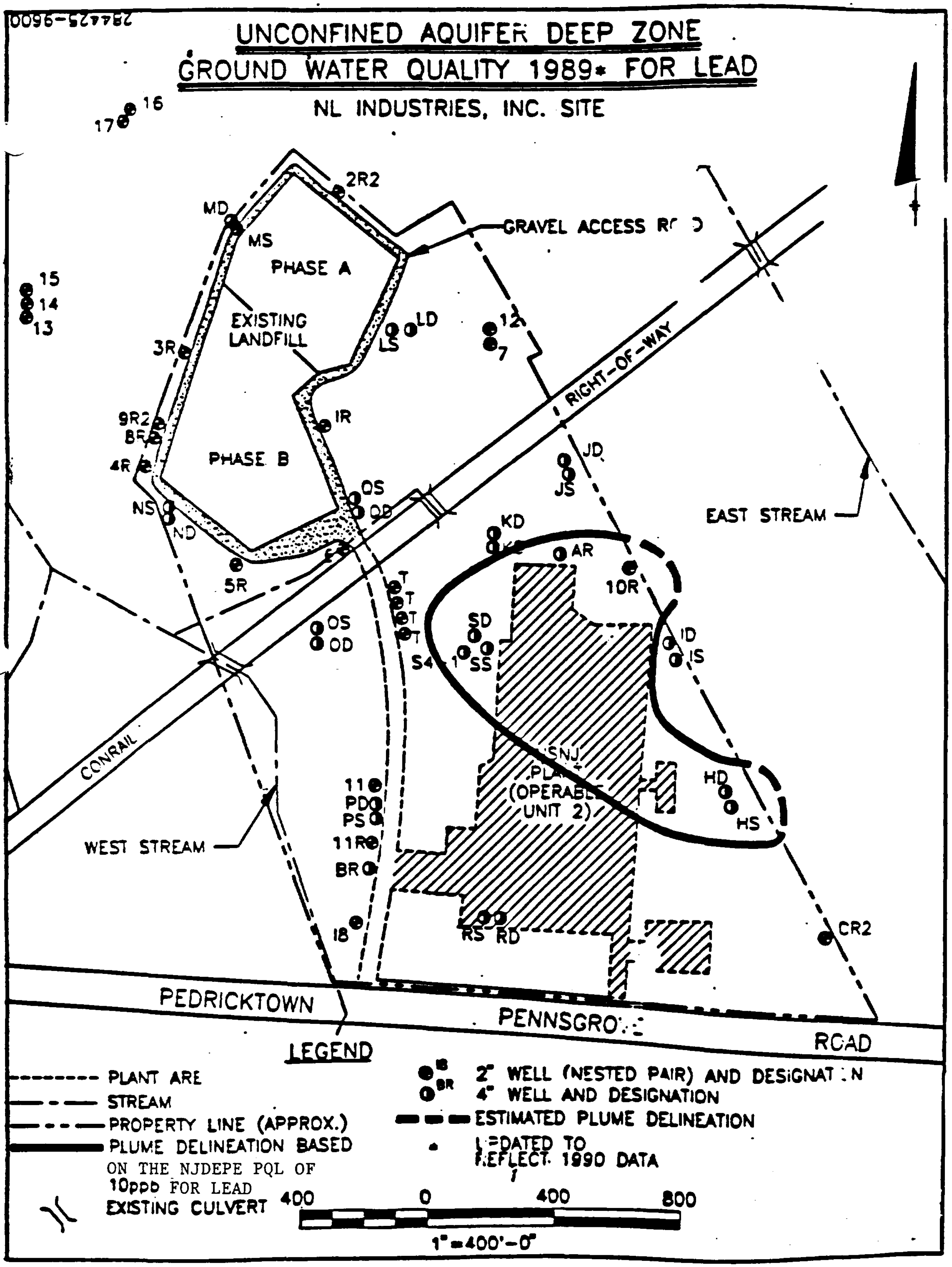


28408-9600
SOIL EXCAVATION ZONES
500 ppm LEAD LIMIT
NL INDUSTRIES, INC. SITE
LEGEND
WETLANDS AREA
PLANT AREA
STREAM
PROPERTY LINE (APPROX.)
SOIL SAMPLE LOCATIONS (LEAD < 500 ppm)
SOIL SAMPLE LOCATIONS (LEAD > 500 ppm)
PROPOSED 18" EXCAVATION
PROPOSED 6" EXCAVATION
PROPOSED 3" EXCAVATION
AA1
AA2
AA3
AA4
AA5
AA9
AA8
NOTE:
TOTAL VOLUME OF EXCAVATION 29,800 CY
(1) BASED ON MAXIMUM OBSERVED CONCENTRATION AT SOIL SAMPLE LOCATION.
800 0 800 1600
1"=800'
O'BRIEN & GERE ENGINEERS INC.

FIGURE 3



NLI 002 2247


284425-9600
UNCONFINED AQUIFER DEEP ZONE
GROUND WATER QUALITY 1989* FOR LEAD
NL INDUSTRIES, INC. SITE
GRAVEL ACCESS RO
PHASE A
EXISTING LANDFILL
PHASE B
RIGHT-OF-WAY
CONRAIL
EAST STREAM
WEST STREAM
SNJ PLANT (OPERABLE UNIT 2)
PEDRICKTOWN PENNSGROVE ROAD
LEGEND
PLANT AREA
STREAM
PROPERTY LINE (APPROX.)
PLUME DELINEATION BASED ON THE NJDEPE PQL OF 10ppb FOR LEAD
EXISTING CULVERT
2" WELL (NESTED PAIR) AND DESIGNATION
4" WELL AND DESIGNATION
ESTIMATED PLUME DELINEATION
* UPDATED TO REFLECT 1990 DATA
400 0 400 800
1"=400'-0"

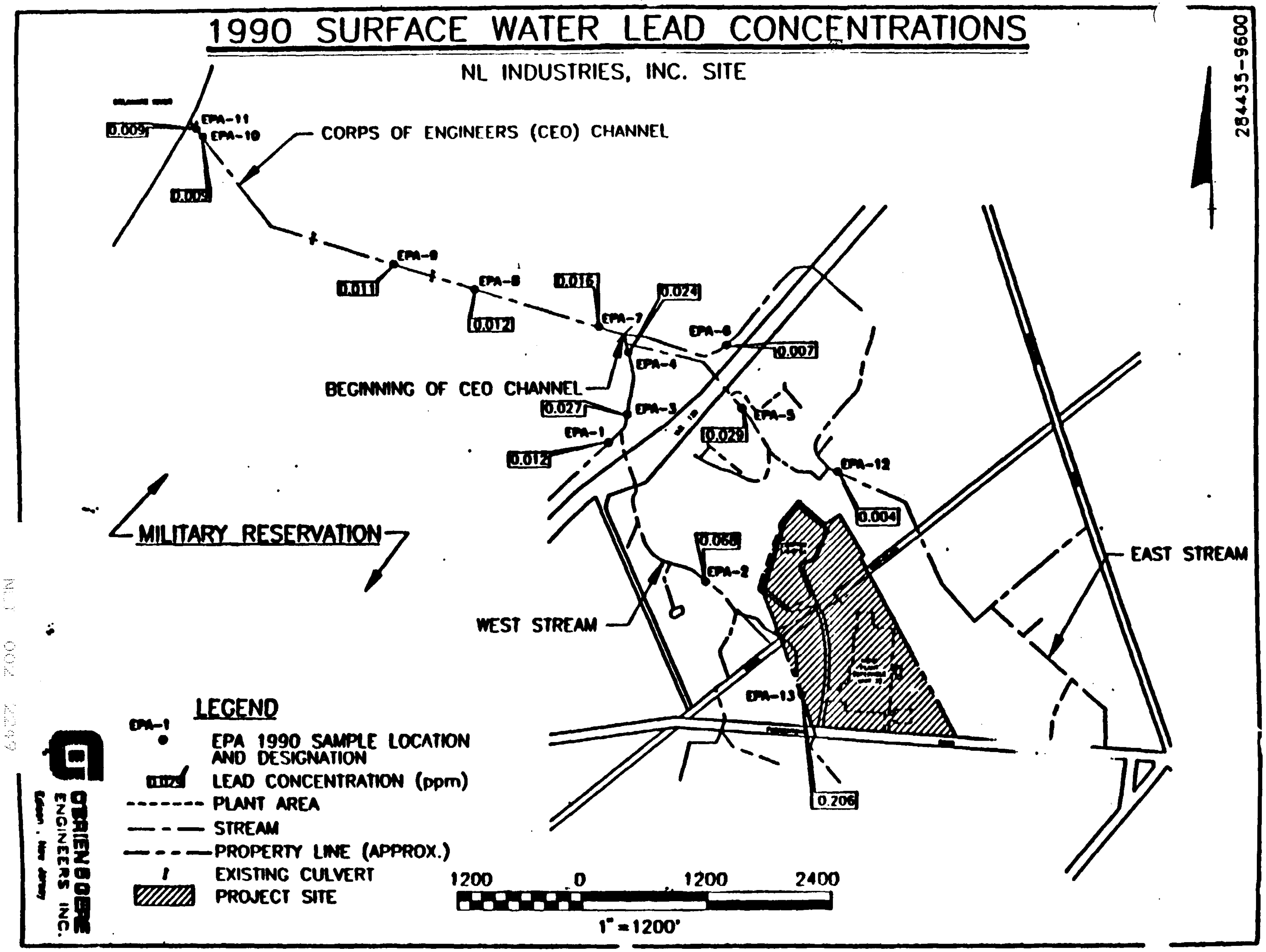

1990 SURFACE WATER LEAD CONCENTRATIONS
NL INDUSTRIES, INC. SITE
CORPS OF ENGINEERS (CEO) CHANNEL
EPA-11
EPA-10
0.009
0.005
EPA-9
0.011
EPA-8
0.012
0.016
EPA-7
0.024
EPA-6
0.007
EPA-4
BEGINNING OF CEO CHANNEL
0.027
EPA-3
EPA-5
0.029
EPA-1
0.012
EPA-12
0.004
MILITARY RESERVATION
0.068
EPA-2
WEST STREAM
EAST STREAM
EPA-13
0.206
LEGEND
EPA-1
EPA 1990 SAMPLE LOCATION AND DESIGNATION
LEAD CONCENTRATION (ppm)
PLANT AREA
STREAM
PROPERTY LINE (APPROX.)
EXISTING CULVERT
PROJECT SITE
1200 0 1200 2400
1" = 1200'
O'BRIEN & GERE ENGINEERS INC.
284435-9600

FIGURE 5

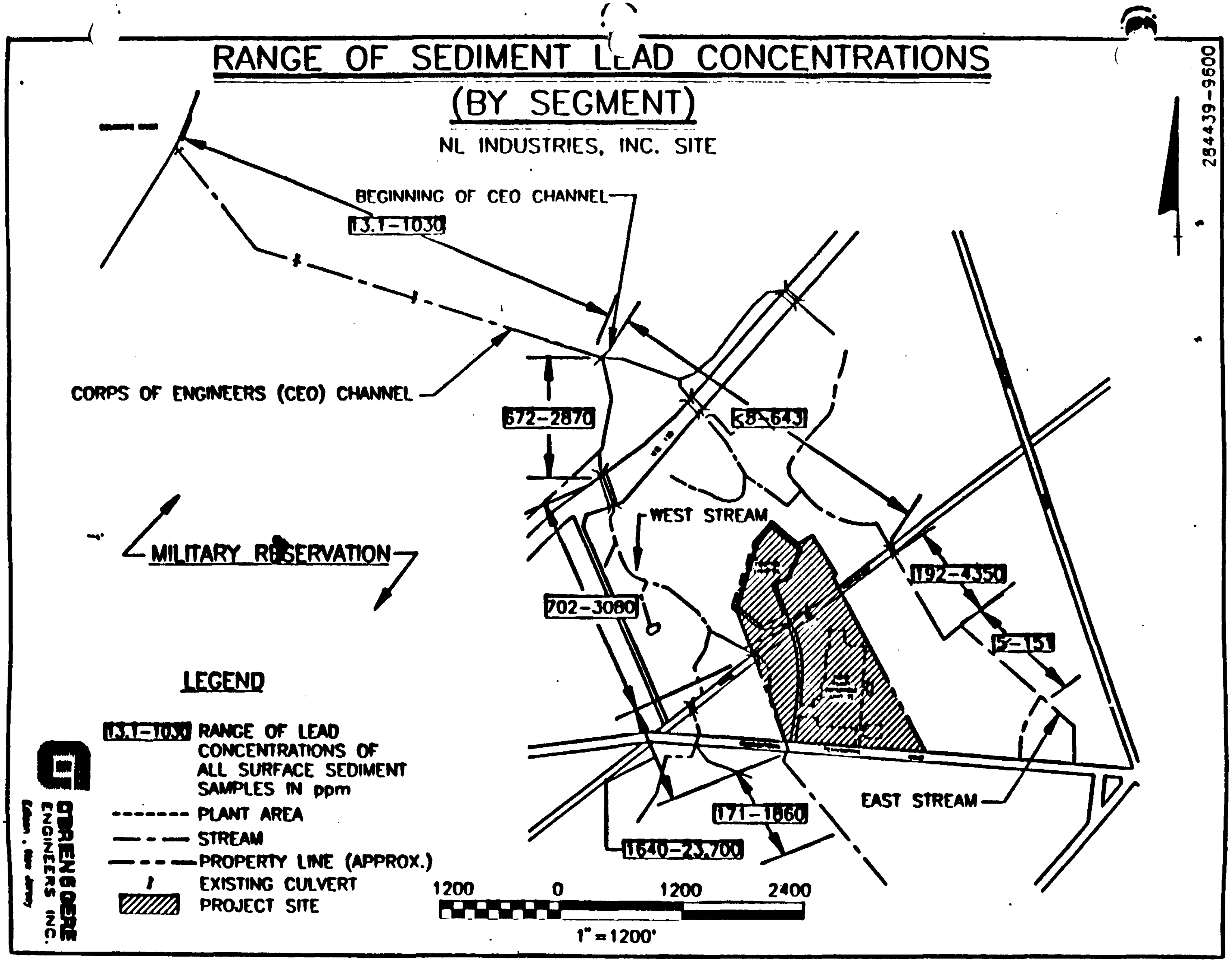


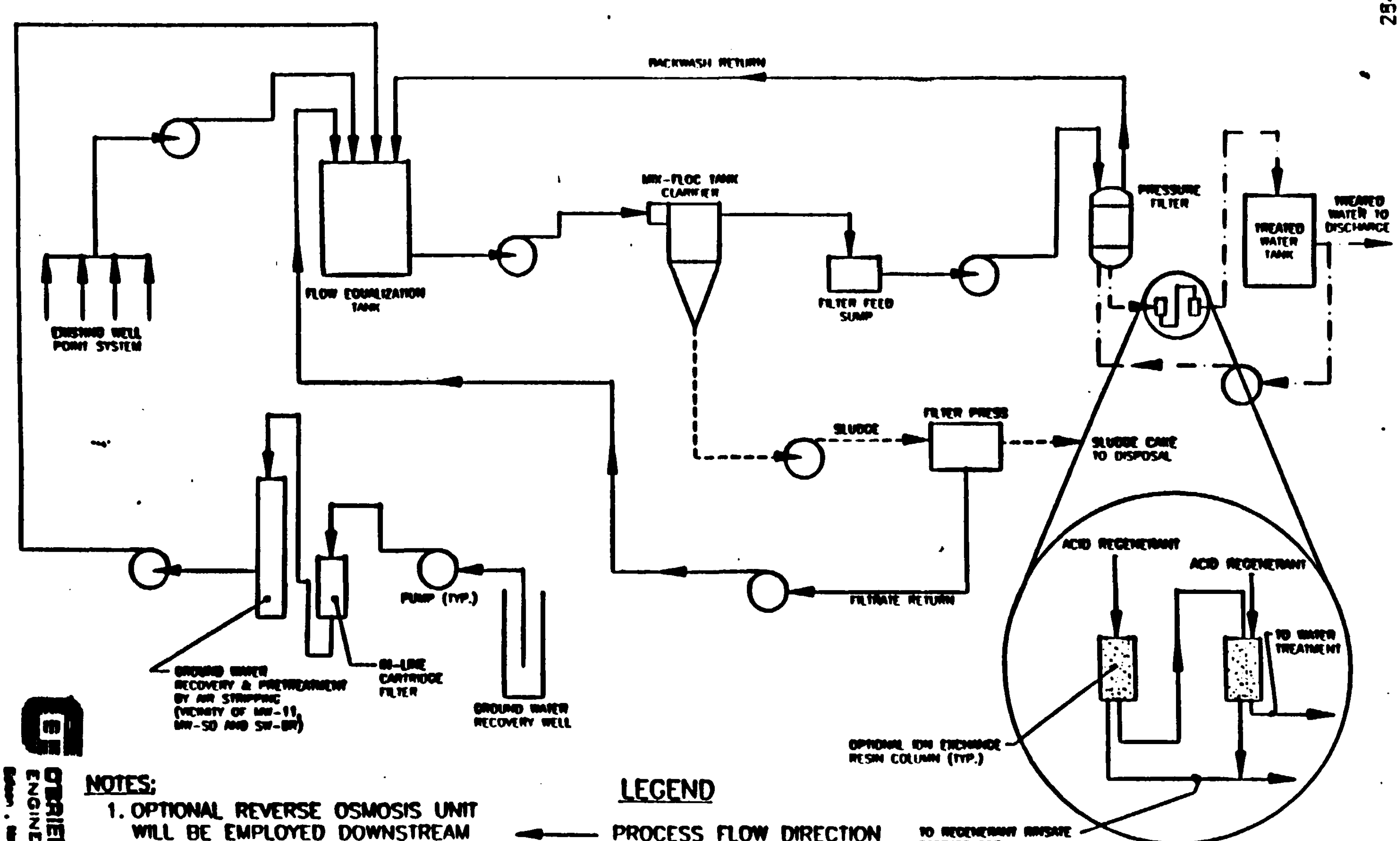
FIGURE 6

NLI 002 2250

GROUND WATER TREATMENT SYSTEM PROCESS SCHEMATIC

NL INDUSTRIES, INC. SITE

284434-9600



O'BRIEN & GERE ENGINEERS INC.

Edison, New Jersey

NOTES:

1. OPTIONAL REVERSE OSMOSIS UNIT WILL BE EMPLOYED DOWNSTREAM OF ION EXCHANGE UNITS, IF NECESSARY, BASED ON TREATMENT PLANT EFFLUENT DISCHARGE LIMITS AND LOCATION.

LEGEND

←———	PROCESS FLOW DIRECTION
- - - - - - -	SLUDGE
— · — · —	TREATED WATER

NOT TO SCALE

FIGURE 7

NLI 002 2251

APPENDIX II

TABLES

TABLE A

CHEMICALS OF CONCERN IN GROUNDWATER

Chemicals of Concern	Frequency of Detect	Range (ug/l)	Concentration Used (ug/l)
Arsenic	34/51	<1-4,900	17
Beryllium			7
Lead*	65/73	1-6,290	2467
1,1-dichloroethane	2/10	54-74	74
1,1-dichloroethylene	2/10	170-210	170
tetrachlorethene	2/10	180-210	180
vinyl chloride	1/10	76	9

* Lead was detected throughout the site. However, it was not used in the quantitative risk assessment due to the lack of an EPA approved toxicity factors.

** The contaminants of concern listed above were identified for the purpose of assessing risk at the NL site.

TABLE A (continued)

CHEMICALS OF CONCERN IN SOILS

Chemicals of Concern	Frequency of Detect	Range (mg/kg)	Concentration Used (mg/kg)			
			OFS RES	OFS WOR	ONS TRS	ONS WOR
Antimony	8/8	0.6-110	N/F	N/F	25	96
Arsenic	11/11	1.65-11.8	9.63	6.31	11.6	11.8
Cadmium	6/6	0.5-3.5	N/F	N/F	3.32	3.50
Chromium	11/11	5.86-19.2	6.26	10.5	8.29	18.9
Copper	11/11	3.25-24.2	8.79	5.60	24.2	24.2
Lead*	110/110	12-12,700	312	355	7500	6636
Zinc	11/11	14.8-57.2	38.1	22.0	57.2	56.5

* Although lead is a contaminant of concern, its contribution to the overall site risk could not be quantitatively assessed due to the lack of an EPA approved toxicity factor.

** The contaminants of concern listed above were identified for the purpose of assessing risk at the NL site.

OFS RES: Off-site resident
OFS WOR: Off-site worker
ONS TRS: On-site trespasser
ONS WOR: On-site worker

N/F:Compound not found.

TABLE B

EXPOSURE PATHWAYS EVALUATED

NL Industries: Exposures evaluated under a future use scenario.

	M E D I A					
Receptor	Soil Ingestion	Soil Dermal	Air (Inhal.)	Ground Water Ingestion	Ground Water Dermal	Ground Water Inhalation
Off-site Child	X	X		X	X	X
Off-site Adult	X	X		X	X	X
Off-site Worker	X	X		X		
On-site Child	X	X	X	X	X	X
On-site Adult	X	X	X	X	X	X
On-site Worker	X	X	X			

*A blank box indicates that this exposure pathway was not complete, and therefore, not calculated.

TABLE B

EXPOSURE PATHWAYS EVALUATED

NL Industries: Exposures evaluated under a current use scenario.

	M E D I A					
Receptor	Soil Ingestion	Soil Dermal	Air (Inhal.)	Ground Water Ingestion	Ground Water Dermal	Ground Water Inhalation
Off-site Child	X	X				
Off-site Adult	X	X				
Off-site Worker	X	X				

*A blank box indicates that this exposure pathway was not complete, and therefore, not calculated.

TABLE C

Toxicity Values For Potential

Carcinogenic Effects

Chemical	Slope Factor (SF) (mg/kg-day)-1	Weight-of Evidence Classification	* Type of Cancer	SF Basis/ SF Source	Comment	Based on Absorbed (ABS)/ Admin. (ADM) dose
ORAL						
Arsenic	1.7E+00	A	skin	water/IRIS	a	ADM
Beryllium	4.3E+00	B2		water/IRIS		ADM
Lead	NA	B2			b	
1,1-Dichloroethane	9.1E-02	C		gavage/HEAST		ADM
1,1-Dichloroethene	6E-01	C		water/IRIS		ADM
Tetrachloroethene	5E-02	B2		gavage/HEAST		ADM
Vinyl chloride	2.3E+00	A	lung	diet/HEAST		ADM
INHALATION						
Arsenic	5.0E+01	A	resp. tract	air/HEAST		ABS
Cadmium	6.1E+00	B1		occup/IRIS		ADM
Chromium	4.1E+01	A	lung	occup/IRIS		ADM
Lead	NA				b	
1,1-Dichloroethene	1.2E+00	C		air/IRIS		ABS
Tetrachloroethene	3.3E-03	B2		air/HEAST		ADM
Vinyl chloride	2.95E-01	A	liver	air/HEAST		ADM

Comments:
- a = calculated from the proposed unit risk (see Appendix K)
- b = not available per EPA personnel (EPA 1990d)

* - types of cancer for Class A carcinogens only

TABLE D

NONCARCINOGENIC TOXICITY INFORMATION

(CHRONIC ORAL EXPOSURE)

Chemical	Chronic RfD (mg/kg-day)	Confidence Level *	Critical Effect	RfD Basis/ RfD Source	Uncertainty & Modifying Factors
Antimony	4E-04	low	longevity, blood chemistry	water/IRIS	UF=1000 (A,H,L), MF=1
Arsenic	1E-03		keratosis	HEAST	UF=1
Beryllium	5E-03	low	none observed	water/IRIS	UF=100 (A,H), MF=1
Cadmium	5E-04	high	renal damage	water/IRIS	UF=10 (H),MF=1
Chromium	5E-03	low	not defined	water/IRIS	UF=500 (A,H,S), MF=1
Copper	NA				
Lead	NA				
Nickel	2E-02	medium	decreased organ wt	diet/IRIS	UF=100 (A,H), MF=3
Selenium	3E-03		hair/nail loss	diet/HEAST	UF=15
Thallium	7E-05		incr. SGOT/serum LDH	diet/HEAST	UF=3000
Zinc	2E-01		anemia	drug/HEAST	UF=10
Sulfate	NA				
1,1-Dichloroethane	1E-01		none	air/HEAST	UF=1000
1,1-Dichloroethene	9E-03	medium	liver lesions	water/IRIS	UF=1000 (A,H,L), MF=1
Tetrachloroethene	1E-02	medium	hepatotoxicity	gavage/IRIS	UF=1000 (A,H,S), MF=1
1,1,1-trichloroethane	9E-02	medium	hepatotoxicity	air/IRIS	UF=1000 (A,H,S), MF=1
vinyl chloride	NA				

* - confidence level from IRIS, either high, medium, or low
NA = not available

Uncertainty adjustments:
H = variation in human sensitivity
A = animal to human extrapolation
S = extrapolation from subchronic to chronic NOAEL
L = extrapolation from LOAEL to NOAEL

TABLE D

NONCARCINOGENIC TOXICITY INFORMATION

(SUBCHRONIC ORAL EXPOSURE)

Chemical	Subchronic RfD (mg/kg-day)	* Confidence Level	Critical Effect	RfD Basis/ RfD Source	Uncertainty Factors	Comments
Antimony	4E-04		longevity, blood chemistry	water/HEAST	UF=1000	
Arsenic	1E-03		keratosis	HEAST	UF=1	
Beryllium	5E-03		none observed	water/HEAST	UF=100	
Cadmium	5E-04		renal damage	water/IRIS	UF=10	a
Chromium	2E-02		not defined	water/HEAST	UF=100	
Copper	NA					
Lead	NA					
Nickel	2E-02		decreased organ wt	diet/HEAST	UF=300	
Selenium	4E-03		mortality	diet/HEAST	UF=100	
Thallium	7E-04		incr. SGOT/serum LDH	HEAST	UF=300	
Zinc	2E-01		anemia	drug/HEAST	UF=10	
Sulfate						
1,1-Dichloroethane	1E+00		none	air/HEAST	UF=100	
1,1-Dichloroethene	9E-03		liver lesions	water/HEAST	UF=1000	
Tetrachloroethene	1E-01		hepatotoxicity	gavage/HEAST	UF=100	
1,1,1-trichloroethane	9E-01		hepatotoxicity	air/HEAST	UF=100	
vinyl chloride	NA					

* - confidence level from IRIS, either high, medium, or low

a - the toxicity value for chronic exposures was used

TABLE D

TOXICITY VALUE ADJUSTMENTS

(DERMAL EXPOSURES)

Chemical	Toxicity Value (Slope Factor)	Based on Absorb. (ABS)/ Admin. (ADM)	Study Species	Absorption Efficiency in Species	Adjusted Toxicity Value (Slope Factor)
Arsenic	1.7E+00	ADM	human	0.95	1.8E+00
Beryllium	4.3E+00	ADM	rat	0.01	4.3E+02
1,1-Dichloroethane	9.1E-02	ADM	rat	0.50	1.8E-01
1,1-Dichloroethene	6E-01	ADM	rat	1.00	6E-01
Tetrachloroethene	5E-02	ADM	rat	1.00	5E-02
Vinyl chloride	2.3E+00	ADM	rat	1.00	2.3E+00

Notes: Only toxicity values based on administered doses were adjusted

Absorption efficiencies were obtained from ATSDR Toxicological Profiles

Slope factors expressed in (mg/kg-day)-1

TABLE D

TOXICITY VALUE ADJUSTMENTS

(DERMAL EXPOSURES)

Chemical	Toxicity Value (RfD) (mg/kg-day)	Based on Absorb. (ABS)/ Admin. (ADM)	Study Species	Absorption Efficiency in Species	Adjusted Toxicity Value (mg/kg-day)
Chronic Exposures					
Antimony	4E-04	ADM	rat	0.05	2E-05
Arsenic	1E-03	ADM	human	0.95	1E-03
Beryllium	5E-03	ADM	rat	0.01	5E-05
Cadmium	5E-04	ABS	human		-
Chromium	5E-03	ADM	rat	0.03	2E-04
Nickel	2E-02	ADM	rat	0.01	2E-04
Selenium	3E-03	ADM	human	0.90	3E-03
Thallium	7E-05	ADM	rat	0.05	4E-06
Zinc	2E-01	ADM	human	0.20	4E-02
1,1-Dichloroethane	1E-01	ADM	rat	0.50	5E-02
1,1-Dichloroethene	9E-03	ADM	rat	1.00	9E-03
Tetrachloroethene	1E-02	ADM	mouse	1.00	1E-02
1,1,1-trichloroethane	9E-02	ABS	guinea pig		-
Subchronic Exposures					
Antimony	4E-04	ADM	rat	0.05	2E-05
Arsenic	1E-03	ADM	human	0.95	1E-03
Beryllium	5E-03	ADM	rat	0.01	5E-05
Cadmium	5E-04	ABS	human		-
Chromium	2E-02	ADM	rat	0.03	6E-04
Nickel	2E-02	ADM	rat	0.01	2E-04
Selenium	3E-03	ADM	human	0.90	3E-03
Thallium	7E-04	ADM	rat	0.05	4E-05
Zinc	2E-01	ADM	human	0.20	4E-02
1,1-Dichloroethane	1E+00	ADM	rat	0.50	5E-01
1,1-Dichloroethene	9E-03	ADM	rat	1.00	9E-03
Tetrachloroethene	1E-01	ADM	mouse	1.00	1E-01
1,1,1-trichloroethane	9E-01	ABS	guinea pig		-

TABLE E

NL Industries: Carcinogenic and Noncarcinogenic Risk Summary Tables

		P A T H W A Y					
Receptor	Risk Index	Soil Ingestion	Soil Dermal	Air (Inhal.)	Ground Water Ingestion	Ground Water Dermal	Ground Water Inhalation
Future							
Off-site Child	Ca	8E-7	9E-8		**5E-4**	9E-6	**3E-4**
	HI	2.4E-3	4.1E-3		**15.78**	0.35	0.09
Off-site Adult	Ca	1E-6	2E-7		**2E-3**	8E-5	**1E-3**
	HI	2E-3	2E-3		**11**	4E-1	**1.0**
Off-site Worker	Ca	9E-7	2E-7		**9E-4**		
	HI	2E-3	4E-3		**3.81**		
On-site Child	Ca	9E-6	2E-6	7E-6	**1E-3**	2E-5	**6E-4**
	HI	**1.3**	**4.7**		**17.32**	0.49	0.10
On-site Adult	Ca	2E-6	3E-7	5E-6	**2E-3**	8E-5	**1E-3**
	HI	0.05	0.16		**10.0**	0.40	0.50
On-site Worker	Ca	2E-6	3E-7	3E-6			
	HI	0.05	0.16				

"Ca" indicates lifetime cancer risk. "HI" indicates the Hazard Index for noncancer risk.

* **A blank box indicates that this exposure pathway was not complete, and therefore, not calculated.**

** **Bold-face type indicates exceedance of either EPA's acceptable Hazard Index of 1.0 or of EPA's lower threshold for Carcinogenic Risk of 1×10^{-4}.**

TABLE E

NL Industries: Carcinogenic and Noncarcinogenic Risk Summary Tables

		P	A	T	H	W	A	Y
Receptor	Risk Index	Soil Ingestion	Soil Dermal	Air (Inhal.)	Ground Water Ingestion	Ground Water Dermal	Ground Water Inhalation
Current							
Off-site	Ca	3E-8	3E-9				
Child	HI	2.4E-3	4.1E-3				
Off-site	Ca	1E-6	2E-7				
Adult	HI	2E-3	2E-3				
Off-site	Ca	9E-7	2E-7				
Worker	HI	1.7E-3	3.6E-3				

"Ca" indicates lifetime cancer risk. "HI" indicates the Hazard Index for noncancer risk.

* A blank box indicates that this exposure pathway was not complete, and therefore, not calculated.

** Bold-face type indicates exceedance of either EPA's acceptable Hazard Index of 1.0 or of EPA's lower threshold for Carcinogenic Risk of 1 x 10^{-4}.

TABLE F
NL INDUSTRIES SITE
GROUND WATER ARARS

HAZARDOUS CONTAMINANT	NJMCL[1]	NJGWQS[2]	PQL[3]	MCL[4]
Organic (ppb)				
Acetone	-	700	NA	-
Bis-(2-ethylhexyl)phthalate	4	3	30	-
Chloroform	-	6	1	-
1,2-Dibromomethane	-	-	-	-
1,1-Dichloroethane	-	70	-	-
1,1-Dichloroethylene	2	1	2	7
1,2-Dichloropropane	5	0.5	1	5
Ethylbenzene	700	700	5	700
Naphthalene	-	-	-	-
N-Nitroso-di-n-propylamine	-	0.005	20	-
Tetrachloroethylene	1	0.4	1	5
Toluene	1,000	1,000	5	1,000
1,1,1-Trichloroethane	26	30	1	200
1,2,4-Trimethylbenzene	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-
Vinyl Chloride	2	0.08	5	2
Xylene(s) (total)	44	40	2	10,000
o-		NA	1	-
m&p-		NA	2	

[1] New Jersey Maximum Contaminant Levels (NJMCLs) are expressed in ppb. (N.J.A.C 7:10-16.7) For any listed contaminant, the more stringent of the NJMCL, NJGWQS, or federal MCL applies.

[2] New Jersey Ground Water Quality Standards (NJGWQS) (N.J.A.C. 7:9-6) are expressed in parts per billion (ppb).

[3] The Practical Quantitation Levels (PQLs) are expressed in ppb. In accordance with N.J.A.C. 7:9-6.9(c), where a constituent standard (the criterion adjusted by the antidegredation policy and applicable criteria exemptions) is of a lower concentration than the relevant PQL, the Department shall not (in the context of an applicable regulatory program) consider the discharge to be causing a contravention of that constituent standard so long as the concentration of the constituent in the affected ground water is less than the relevant PQL.

[4] Federal Maximum Contaminant Levels (MCLs) are expressed in ppb. For any listed contaminant, the more stringent of the federal MCL, NJMCL, and the NJGWQS applies.

TABLE F (Cont'd)
NL INDUSTRIES SITE
GROUND WATER ARARS

HAZARDOUS CONTAMINANT	NJMCL[1]	NJGWQS[2]	PQL[3]	MCL[4]
Metals (ppb)				
Antimony	6	2	20	6
Arsenic (total)	50	0.02	8	50
Beryllium	4	0.008	20	4
Cadmium	5	4	2	5
Chromium (total)	100	100	10	100
Copper	1,300*	1,000	1,000	-
Cyanide	200	200	40	200
Lead (total)	15*	5	10	-
Mercury (total)	2	2	0.5	2
Nickel (soluble salts)	100	100	10	100
Selenium (total)	50	50	10	50
Silver	-	NA	2	-
Thallium	2	0.5	10	2
Zinc	-	5,000	30	-
Radiation (see footnotes 4 & 5 for units)				
Gross Alpha	15[5]	15[5]	-	15[5]
Gross Beta	4[6]	4[6]	-	4[6]

* New Jersey Action Level

[5]Federal MCL expressed in picocuries/liter (pC/l). From 40 CFR part 141.

[6]Federal MCL expressed in picocuries/liter (pC/l). From 40 CFR part 141.

TABLE G1

PERMIT EQUIVALENT SUMMARY - TABLE I

OUTFALL 001

Facility: NL Industries Superfund Site | Latitude: 39° 45' 40" N | Longitude: 75° 25' 20" W
Type of Wastewater: Treated Groundwater | Average Flow: 250 GPM | Discharged to: West or East stream

PARAMETER	WORST CASE INFLUENT DATA	WATER QUALITY BASED LIMITS		TECHNOLOGY BASED LIMITS		METHOD DETECTION LEVEL	EPA METHOD NUMBER	PERMIT EQUIVALENT EFFLUENT LIMIT	
All values are in ug/l unless otherwise stated		MON AVG	DAY MAX	MON AVG	DAY MAX	(ug/l)		MON AVG	DAY MAX
CONVENTIONAL AND NON-CONVENTIONAL POLLUTANTS									
Flow (Million Gallons/Day)	0.360	-	-	-	-	-	-	0.360	Report
BOD5 (mg/l)	-	-	-	-	25 (1)	-	-	Report	25 (1)
Chloride (mg/l)	150	-	250	-	-	-	-	Report	250
(kg/day)			340					-	340
Dissolved Oxygen (mg/l)	-	5.0 minimum		-	-	-	-	5.0 minimum	
pH (standard units)	-	-	-	6.0 min	9.0	-	-	6.0 min	9.0
Petroleum Hydrocarbons (mg/l)	-	-	-	10	15 (2)	-	-	10 (2)	15 (2)
Sulfate (mg/l)	24000	-	250	-	-	-	-	Report	250
(kg/day)			340					-	340
Total Dissolved Solids (mg/l)	-	-	500	-	-	-	-	Report	500
(kg/day)			680					-	680
Total Organic Carbon (mg/l)	-	-	-	-	50 (3)	-	-	Report	50 (3)
Total Suspended Solids (mg/l)	-	-	40	-	-	-	-	Report	40
(kg/day)			54					-	54
Chronic Toxicity (% effluent)	-	NOEC ≥ 100 (4)		-	-	-	-	NOEC ≥ 100 (4)	
VOLATILE COMPOUNDS									
Bromodichloromethane	6.3	0.27	0.54	-	-	0.1	601	0.27	0.54
(kg/day)		0.00037	0.00074					0.00037	0.00074
Chloroform	13	5.7	11	-	-	-	-	5.7	11
(kg/day)		0.0078	0.015					0.0078	0.015
1,1-Dichloroethane	74	-	-	5.0	10 (5)	-	-	5.0 (5)	10 (5)
1,2-Dichloroethane	22	0.38	0.76	-	-	0.03	601	0.38	0.76
(kg/day)		0.00052	0.0010					0.00052	0.0010
1,1-Dichloroethylene	210	0.57	1.1	-	-	0.13	601	0.57	1.1
(kg/day)		0.00078	0.0015					0.00078	0.0015
Tetrachloroethylene	210	8.0	16	-	-	-	-	8.0	16
(kg/day)		0.011	0.022					0.011	0.022
1,1,1-Trichloroethane	4700	-	-	21	54 (6)	-	-	21 (6)	54 (6)
Vinyl Chloride	76	2.0	4.0	-	-	0.18	601	2.0	4.0
(kg/day)		0.0027	0.0054					0.0027	0.0054

Permit Equivalent Summary Table (continued) TABLE G1 (Cont'd)

PARAMETER	WORST CASE INFLUENT DATA	WATER QUALITY BASED LIMITS		TECHNOLOGY BASED LIMITS		METHOD DETECTION LEVEL	EPA METHOD NUMBER	PERMIT EQUIVALENT EFFLUENT LIMIT	
All values are in ug/l unless otherwise stated		MON AVG	DAY MAX	MON AVG	DAY MAX	(ug/l)		MON AVG	DAY MAX
ACID AND BASE/NEUTRAL COMPOUNDS									
bis(2-Ethylhexyl) Phthalate	13	18	36	5.0	10 (5)	-	-	5.0 (5)	10 (5)
(kg/day)		0.024	0.048						
N-Nitrosodi-n-propylamine	11	-	-	0.5	1.0 (5)	0.46	607	0.5 (5)	1.0 (5)
METALS									
Aluminum, total recoverable	69	-	-	75	150 (5)	-	-	75 (5)	150 (5)
Antimony, total recoverable	122	14	28	-	-	-	-	14	28
(kg/day)		0.019	0.038					0.019	0.038
Arsenic, total recoverable	18200	0.018	0.036	-	-	0.5	200.9	Report	0.036
(kg/day)		0.000024	0.000048					-	-
Beryllium, total recoverable	156	-	-	0.5	1.0 (5)	0.3	200.8	0.5 (5)	1.0 (5)
Cadmium, total recoverable	1010	0.66	1.3	-	-	0.5	200.8	0.66	1.3
(kg/day)		0.00090	0.0018					0.00090	0.0018
Chromium, total recoverable	4340	8.0	16	-	-	-	-	8.0	16
(kg/day)		0.011	0.022					0.011	0.022
Cobalt, total recoverable	38	-	-	10	20 (5)	-	-	10 (5)	20 (5)
Copper, total recoverable	4680	5.9	12	-	-	-	-	5.9	12
(kg/day)		0.0080	0.016					0.0080	0.016
Iron, total recoverable	429	-	-	100	200 (5)	-	-	100 (5)	200 (5)
Lead, total recoverable	6290	1.5	3.0	-	-	0.7	200.9	1.5	3.0
(kg/day)		0.0020	0.0040					0.0020	0.0040
Manganese, total recoverable	3120	-	-	100	200 (5)	-	-	100 (5)	200 (5)
Mercury, total recoverable	0.6	0.0098	0.020	-	-	0.2	245.1	Report	0.020
(kg/day)		0.000013	0.000026					-	-
Nickel, total recoverable	2480	90	180	50	100 (5)	-	-	50 (5)	100 (5)
(kg/day)		0.12	0.24						
Selenium, total recoverable	4	4.1	8.2	-	-	0.6	200.9	4.1	8.2
(kg/day)		0.0056	0.011					0.0056	0.011
Silver, total recoverable	44	0.97	1.9	-	-	0.5	200.9	0.97	1.9
(kg/day)		0.0013	0.0026					0.0013	0.0026
Thallium, total recoverable	3	1.7	3.4	-	-	0.7	200.9	1.7	3.4
(kg/day)		0.0023	0.0046					0.0023	0.0046
Zinc, total recoverable	9690	40	80	-	-	-	-	40	80
(kg/day)		0.055	0.11					0.055	0.11
RADIONUCLIDES									
Gross alpha particle activity (pCi/l)	570±180	-	15 (7)	-	-	-	-	Report	15 (7)
Gross beta particle activity (pCi/l)	700±180	-	50 (8)	-	-	-	-	Report	50 (8)
Combined Radium-226 and Radium-228 (pCi/l)	100±10	-	5.0	-	-	-	-	Report	5.0

Permit Equivalent Summary Table (continued)

TABLE G1 (Cont'd)

(1) Based on Minimum Treatment Requirements (N.J.A.C. 7:9-5.8) for the Delaware River Basin - FW2 waters.

(2) Based on Oil and Grease Effluent Limitations (N.J.A.C. 7:14A-14.1 et seq.); also, no visible sheen.

(3) Based on Use of Indicators of Pollution Levels (N.J.A.C. 7:9-5.5) and similar effluent limits for discharges of treated groundwater into surface waters, which have been economically achievable.

(4) This limitation is equivalent to 1.0 TU_c (Chronic Toxic Units) maximum.

(5) Based on USEPA Water Engineering Research Laboratory (WERL) Treatability Database for similar discharges and corresponding treatment technologies commonly used.

(6) Based on final USEPA Effluent Guidelines for the Organic Chemicals, Plastics and Synthetic Fibers (OCPSF) point source category for discharges that use end-of-pipe biological treatment.

(7) Gross alpha particle activity including Radium-226, but excluding Radon and Uranium.

(8) Gross beta particle activity exceeding 50 pCi/l must be accompanied by a sample analysis identifying the major radioactive constituents present and compliance with 40 CFR 141.16 (shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirems/year).

Table G2
ESTIMATED **
CHEMICAL-SPECIFIC ARARs & TBCs
FOR DISCHARGE TO THE
DELAWARE RIVER

Compound	Maximum Conc. Detected in Ground Water (µg/l)	Delaware River Discharge Zone 5 Saltwater[o] (µg/l)		
		Criterion Maximum Conc.	Criterion Contin. Conc.	1E-06 Human Health Risk: Organisms Only
Volatile Organics				
Acetone	14			
Bis(2-ethylhexyl)phthalate	13			59[a,c]
Chloroform	7			470[a,c]
1,2-Dibromomethane	2			
1,1-Dichloroethane	74			
1,1-Dichloroethylene	210			3.2[a,c]
1,2-Dichloropropane	0.5			
Ethylbenzene	0.6			29,000[a]
Naphthalene	2.3			
N-Nitroso-di-n-propylamine	11			
Tetrachloroethene	210			8.85[c]
Toluene	1.8			200,000[a]
1,1,1-Trichloroethane	4,700			170,000[p]
1,3,5-Trimethylbenzene	0.8			
1,2,4-Trimethylbenzene	2.7			
Vinyl chloride	76			525[c]
Xylenes (total)	5.6			
Xylene (m & p)	4			
o-Xylene	1.6			
Inorganic Compounds				
Antimony	122			4300[a]
Arsenic	18,200	69	36	0.14[abc]
Beryllium	156			0.131[p]
Cadmium	1,010	43	9.3	n
Chloride	150,000			
Chromium	J4,340	1100	50	n
Copper	J4,680	2.9	2.9	
Lead	6,290	220	8.5	n
Mercury	0.6	2.1	.025	.15

Table G2
ESTIMATED **
CHEMICAL-SPECIFIC ARARs & TBCs
FOR DISCHARGE TO THE
DELAWARE RIVER

Compound	Maximum Conc. Detected in Ground Water (μg/l)	Delaware River Discharge Zone 5 Saltwater[o] (μg/l)		
		Criterion Maximum Conc.	Criterion Contin. Conc.	1E-06 Human Health Risk: Organisms Only
Nickel	2,480	75	8.3	4600
Silver	37	2.3		
Sulfate	25x10^6			
Thallium	3			6.3a
Zinc	9,690	95	86	

Note: The following conventional parameter limits must also be considered for discharge to the Delaware River:

Parameter	**Estimated Discharge Limit**	**Rationale**
BOD	87% removal	Delaware River Basin Commission (DRBC)
COD	No Limit	DRBC
TDS	1,000 ppm or 133% of background concentration	DRBC
pH	6.0-8.5	NJAC 7:9-4.
TSS	45 ppm or 85% removal	Maximum 7-day average: DRBC
Whole effluent toxicity	Under development	NJDEPE

Treatability testing will determine the ability of a treatment system to meet these limits.

From the Federal Register/ Vol. 57, No. 246/ December 22, 1992/ 60912-60922, 40 CFR §131.36
[a] Criteria revised to reflect current agency RfD, as contained in IRIS.
[b]The criteria refers to the inorganic form only.
[c]Criteria matrix based upon carcinogenaity of (10 E-06).
[e]Freshwater aquatic criteria expressed as a function of total hardness. Assumes hardness of 100 (mg/l) and water effects ration of 1.0.
[m]Criteria expressed as a function of the water effects ratio as defined in 40 CFR 131.36(c).
[n]EPA is not promulgating human health criteria for this contaminant. Permit authorities should address this contaminant in NJPDES permit.
[o]New Jersey Surface Water Quality Standards NJAC 7:9-4.1.
[p]Federal Ambient Water Quality Criteria

** All final discharge values will be developed by NJDEPE through the issuance of a New Jersey Discharge Pollution Elimination System permit.
— Value not available.
ND = Not Detected

TABLE H

LIST OF ARARS

Chemical-Specific ARARs:

- **RCRA Identification of Hazardous Waste (40 CFR 261)**
- **New Jersey Regulation for Hazardous Waste Identification (NJAC 7:26-8)**
- **National Ambient Air Quality Standards (NAAQS) (contained in 40 CFR 50)**
- **New Jersey Ambient Air Quality Standards (NJAC 7:27-13)**
- **Safe Drinking Water Act, Maximum Contaminant Levels (MCLs) (40 CFR 141.11-16)**
- **New Jersey Surface Water Quality Standards (NJAC 7:9-4)**
- **New Jersey Limitations on Discharge of Effluents to Surface Water (as provided in NJAC 7:14 A-1 <u>et</u> <u>seq</u>.)**
- **Federal Ambient Water Quality Criteria, as contained in the Toxic Rule, 40 CFR §131.36**
- **New Jersey Ground Water Quality Standards (contained in NJAC 7:9-6)**
- **New Jersey Safe Drinking Water Act Maximum Contaminant Levels (NJAC 7:10-16.7)**

Action-Specific ARARs:

- **RCRA Subtitle C Closure and Post-Closure Standards (40 CFR 264, Subpart G)**
- **RCRA Standards for Generators of Hazardous Waste (40 CFR 262)**
- **RCRA Ground Water Monitoring and Protection Standards (40 CFR 264, Subpart F)**
- **RCRA Transporter Requirements for Manifesting Waste for Off-site Disposal (40 CFR 263)**
- **RCRA Transporter Requirements for Off-Site Disposal (40 CFR 263)**
- **RCRA Subtitle D Nonhazardous Waste Management Standards (40 CFR 257)**
- **RCRA Land Disposal Restrictions (40 CFR 268) (On- and off-site disposal of materials)**
- **DOT Rules for Hazardous Materials Transport (49 CFR 171-179)**

- New Jersey RCRA Closure and Post-Closure Standards (NJAC 7:26-1 et seq.)

- New Jersey Noise Pollution Regulations (NJAC 7:29 et seq.)

- New Jersey Nonhazardous Waste Management Requirements (NJAC 7:26-2)

- New Jersey Air Pollution Control Regulations (NJAC 7:27 et seq.)

- New Jersey Soil Erosion and Sediment Control Act Requirements (NJSA 4:24-42 and NJAC 2:90-1.1 et seq.)

Location-Specific ARARs:

- The Clean Water Act (Section 404)

- The Coastal Zone Management Act

- New Jersey Freshwater Wetlands Regulations

- Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands)

Location-Specific To-Be-Considered

- EPA Policy on Floodplains and Wetlands Assessments for CERCLA Actions (OSWER Directive #9280.0-02)

Chemical-Specific To-Be-Considered

- Clean Water Act, Water Quality Criteria (Section 304(a)) (May 1, 1987 - Gold Book);

- EPA's Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites, OSWER Directive #9355.4-02

TABLE 1. Lead concentrations measured in soil and earthworms from *in situ* bioaccumulation chambers. Earthworms were exposed to site soils for 30 days.
National Lead Industries Site
Pedricktown, New Jersey

	Lead in Soil (mg/kg dry weight)		Mean Percent	Lead in Soil (mg/kg wet weight)		Lead in Earthworms (mg/kg wet weight)	
	Mean	SD	Moisture	Scenario 1[a]	Scenario 2[b]	Mean	SD
Soil lead < 500 mg/kg	246.0	129.3	24.9	184.7	281.9	66.3	44.2
Soil lead 500 - 1000 mg/kg	786.7	58.6	29.7	553.1	594.2	80.0	48.1
Soil lead > 1000 mg/kg	3150.0	2290.5	48.9	1609.7	2780.1	85.7	42.7

[a] Scenario 1 calculated using mean lead levels in sediment
[b] Scenario 2 calculated using mean lead levels plus one standard deviation

TABLE 2. Lead concentration measured in sediment and green frogs (*Rana clamitans*) collected from the East and West stream drainages. Lead in sediments was analyzed using XRF.
National Lead Industries Site
Pedricktown, New Jersey

	Lead in Sediment (mg/kg dry weight)		Percent Moisture[a]	Lead in Sediment (mg/kg wet weight)		Lead in Frogs (mg/kg wet weight)	
	Mean	SD		Scenario 1[b]	Scenario 2[c]	Mean	SD
Sediment lead < 1000 mg/kg	862	201	57.0	371	457	5.02	3.96
Sediment lead 1000 - 2000 mg/kg	1024	285	57.0	440	563	5.00[d]	5.09
Sediment lead > 2000 mg/kg	4568[d]	62	57.0	1963	1991	13.32	6.90

[a] Mean percent moisture measured in 5 sediment samples collected for TOC and grain size analysis.
[b] Scenario 1 calculated using mean lead levels in sediment
[c] Scenario 2 calculated using mean lead levels plus one standard deviation
[d] Based on a sample size of n = 2.

TABLE 3. Mean whole body lead concentration in white-footed mice (*Peromyscus leucopus*) captured on-site. National Lead Industries site. Pedricktown, New Jersey

	Number of animals	Mean lead concentration (mg/kg wet weight)	Standard deviation	Range of values
Area I and IA	11	1.60	1.07	0.20 - 3.30
Area II	15	3.10	3.02	0.87 - 13.0
Area III	12	4.77	3.49	0.89 - 13.0

TABLE 4. Lead concentration in surface soils in small mammal trapping grids as measured by XRF.
National Lead Industries Site
Pedricktown, New Jersey

	Lead in Soils (mg/kg dry weight)		Percent Moisture[a]	Lead in Soils (mg/kg wet weight)	
	Mean	SD		Scenario 1[b]	Scenario 2[c]
Grid I	1963	1062	40.04	1177	1814
Grid IA	1515	771	40.04	908	1371
Area I (Grids I and IA)	1705	914	40.04	1022	1570
Area II	917	801	40.04	550	1030
Area III	2277	1439	40.04	1365	2228

[a] Percent moisture is mean percent moisture measured in soils from earthworm chambers, n = 20.
[b] Scenario 1 calculated using mean lead levels in sediment
[c] Scenario 2 calculated using mean lead levels plus one standard deviation

TABLE 5. Lead levels measured in surface water samples.
Results are from samples collected during the Remedial Investigation in 1988 and 1989.
National Lead Industries Site
Pedricktown, New Jersey

	Sample size	Mean Lead (mg/kg)	Standard Deviation (mg/kg)	Range of values (mg/kg)
Low (< 0.1 mg/kg)	13	0.049	0.033	0.010 - 0.098
Medium (0.1 - 1.0 mg/kg)	10	0.257	0.129	0.100 - 0.418
High (> 1.0 mg/kg)	7	1.847	0.696	1.06 - 3.00

TABLE 5-b

EXPOSURE PROFILES FOR THE ECOLOGICAL RISK ASSESSMENT

Robin	Ingestion of earthworms Ingestion of soils
Woodcock	Ingestion of earthworms Ingestion of soils
Great blue heron	Ingestion of aquatic biota (frogs) Ingestion of sediment Ingestion of water
Red-tailed hawk	Ingestion of small mammals
Long-eared owl	Ingestion of small mammals
Red fox	Ingestion of small mammals Ingestion of soil
Mink	Ingestion of small mammals Ingestion of aquatic biota (frogs) Ingestion of soil Ingestion of water

TABLE 6. Daily intake of lead by biota utilizing forage from the NL Industries site
Scenario 1 calculated using mean lead levels detected on-site; Scenario 2 calculated using mean lead plus one standard deviation

RECEPTOR SPECIES	LEAD IN MEDIA (mg/kg)	SCENARIO 1 DAILY INTAKE (mg/kg bodyweight/day)				SCENARIO 2 DAILY INTAKE (mg/kg bodyweight/day)			
		Forage	Soil/ Sediment	Water	Total	Forage	Soil/ Sediment	Water	Total
ROBIN	Soil, < 500	3.16	1.89	nc	5.05	5.27	2.88	nc	8.15
	Soil, 500-1000	3.82	5.64	nc	9.46	6.11	6.06	nc	12.17
	Soil, > 1000	4.09	16.42	nc	20.51	6.13	28.37	nc	34.49
WOODCOCK	Soil, < 500	33.35	8.41	nc	41.76	55.58	12.82	nc	68.40
	Soil, 500-1000	40.24	25.41	nc	65.38	64.44	27.00	nc	91.44
	Soil, > 1000	43.11	73.14	nc	116.25	64.59	126.36	nc	190.95
GREAT BLUE HERON AUF = 0.3%	Sediment, < 1000	0.00	0.02	0.00	0.02	0.01	0.02	0.00	0.03
	Sediment, 1000-2000	0.00	0.02	0.00	0.02	0.01	0.03	0.00	0.04
	Sediment, > 2000	0.01	0.11	0.00	0.12	0.01	0.11	0.00	0.12

nc indicates exposure pathway not considered for this species
AUF = Area use factor

TABLE 6 (continued). Daily intake of lead by biota utilizing forage from the NL Industries site
Scenario 1 calculated using mean lead levels measured on-site; Scenario 2 calculated using mean lead plus one standard deviation

RECEPTOR SPECIES	LEAD IN MEDIA (mg/kg)	SCENARIO 1 DAILY INTAKE (mg/kg bodyweight/day)				SCENARIO 2 DAILY INTAKE (mg/kg bodyweight/day)			
		Forage	Soil	Water	Total	Forage	Soil	Water	Total
GREAT BLUE HERON AUF = 50%	Sediment, < 1000	0.50	3.34	0.00	3.84	0.90	4.11	0.00	5.01
	Sediment, 1000-2000	0.50	3.96	0.01	4.47	1.01	5.07	0.01	6.08
	Sediment, > 2000	1.33	17.67	0.04	19.04	2.02	17.92	0.05	19.99
RED-TAILED HAWK	Area II < 1000	0.20	nc	nc	0.20	0.40	nc	nc	0.40
	Area I & IA 1000-2000	0.11	nc	nc	0.11	0.18	nc	nc	0.18
	Area III > 2000	0.31	nc	nc	0.31	0.54	nc	nc	0.54
LONG-EARED OWL	Area II < 1000	0.53	nc	nc	0.53	1.05	nc	nc	1.05
	Area I & IA 1000-2000	0.27	nc	nc	0.27	0.46	nc	nc	0.46
	Area III > 2000	0.82	nc	nc	0.82	1.41	nc	nc	1.41

nc indicates exposure pathway not considered for this species
AUF = Area use factor

TABLE 6 (continued). Daily intake of lead by biota utilizing forage from the NL Industries site
Scenario 1 calculated using mean lead levels detected on-site; Scenario 2 calculated using mean lead plus one standard deviation

	LEAD IN MEDIA (mg/kg)	SCENARIO 1 DAILY INTAKE (mg/kg bodyweight/day)				SCENARIO 2 DAILY INTAKE (mg/kg bodyweight/day)			
		Forage	Soil/ Sediment	Water	Total	Forage	Soil/ Sediment	Water	Total
RED FOX	Area II < 1000	0.20	0.99	nc	1.19	0.39	1.85	nc	2.25
	Area I & IA 1000-2000	0.10	1.84	nc	1.94	0.17	2.83	nc	3.00
	Area III > 2000	0.31	2.46	nc	2.76	0.53	4.01	nc	4.54
MINK, MALE	Area II < 1000	0.55	2.08	0.02	2.63	1.02	3.89	0.03	4.95
	Area I & IA 1000-2000	0.45	3.86	0.00	4.31	0.86	5.93	0.01	6.80
	Area III > 2000	1.22	5.16	0.17	6.55	1.92	8.42	0.23	10.57
MINK, FEMALE	Area II < 1000	0.61	2.31	0.03	2.94	1.13	4.33	0.04	5.50
	Area I & IA 1000-2000	0.50	4.29	0.00	4.82	0.96	6.59	0.01	7.56
	Area III > 2000	1.36	5.73	0.18	7.27	2.14	9.36	0.25	11.75

nc indicates exposure pathway not considered for this species

TABLE 7. Summary of lethal and sublethal effects of ingested lead.

SPECIES	EXPOSURE PERIOD	DIETARY EXPOSURE (mg/kg/day)	EFFECT	REFERENCE
Red-tailed Hawk[a]	30 Weeks	3	Clinical symptoms of lead poisoning	(Reiser and Temple 1981)
Otter[b]	Lifetime	0.15	No apparent population level effects	(Mason and MacDonald 1986)
Otter[b]	Lifetime	2.00	Reduced population	(Mason and MacDonald 1986)
Dog[c]	2 Years	2.5[f]	Inhibition of ALAD	(Azar *et al.* 1973)
Dog[c]	180 Days	3	Anorexia and convulsions	(Clark 1979)
European Starling[d]	Lifetime	4.1[g]	Reduced brain weight in nestlings, reduction in ALAD in red blood cells of adults and nestlings	(Grue *et al.* 1986)
Mallard[e]	42 Days	20[h]	Elevated lead levels in bone and eggs	(Haegele *et al.* 1974)

[a] Surrogate for long-eared owl
[b] Surrogate for mink
[c] Surrogate for fox
[d] Surrogate for robin and woodcock
[e] Surrogate for great blue heron
[f] Dose calculated from reported dose of 100 mg/kg based on average dog bodyweight of 10 kg and ingestion rate of 250 g/day
[g] Dose calculated from reported dose of 13.3 mg/kg (wet weight) based on average starling bodyweight of 75 g and ingestion rate of 23 g/day
[h] Dose calculated from reported dose of 100 mg/kg based on average mallard bodyweight of 1.25 g and ingestion rate of 0.25 kg/day

TABLE 8. Risk Estimates for Biota Utilizing the NL Industries site

SPECIES	LEAD IN MEDIA (mg/kg)	LOAEL (mg/kg/day)	DAILY INTAKE (SCENARIO 1) (mg/kg/day)	HAZARD QUOTIENT[1]	DAILY INTAKE (SCENARIO 2) (mg/kg/day)	HAZARD QUOTIENT
ROBIN	Soil, < 500	4.1	5.05	1.23	8.15	1.99
	Soil, 500-1000	4.1	9.46	2.31	12.17	2.97
	Soil, > 1000	4.1	20.51	5.00	34.49	8.41
WOODCOCK	Soil, < 500	4.1	41.76	10.19	68.40	16.68
	Soil, 500-1000	4.1	65.38	15.95	91.44	22.30
	Soil, > 1000	4.1	116.25	28.36	190.95	46.57
GREAT BLUE HERON AUF = 0.3%	Sediment, < 1000	20	0.02	0.00	0.03	0.00
	Sediment, 1000-2000	20	0.02	0.00	0.04	0.00
	Sediment, > 2000	20	0.12	0.01	0.12	0.01

Scenario 1: Dose calculated using mean lead concentration in animals
Scenario 2: Dose calculated using mean lead level plus 1 standard deviation
LOAEL: From Table 7
[1] The hazard quotient method compares calculated exposure concentrations to levels which have been shown to cause an ecological effect (Daily intake + Reference dose = Hazard quotient). A hazard quotient greater than 1 indicates that exposure to contaminants at calculated levels may cause deleterious effects.

NLI 002 2283

TABLE 8 (continued). Risk Estimates for Biota Utilizing the NL Industries site

SPECIES	LEAD IN MEDIA (mg/kg)	LOAEL (mg/kg/day)	DAILY INTAKE (SCENARIO 1) (mg/kg/day)	HAZARD QUOTIENT[1]	DAILY INTAKE (SCENARIO 2) (mg/kg/day)	HAZARD QUOTIENT
GREAT BLUE HERON AUF = 50%	Sediment, < 1000	20	3.84	0.19	5.01	0.25
	Sediment, 1000-2000	20	4.47	0.22	6.08	0.30
	Sediment, > 2000	20	19.04	0.95	19.99	1.00
RED-TAILED HAWK	Area II < 1000	3	0.20	0.07	0.40	0.13
	Area I & IA 1000-2000	3	0.11	0.04	0.18	0.06
	Area III > 2000	3	0.31	0.10	0.54	0.18
LONG-EARED OWL	Area II < 1000	3	0.53	0.18	1.05	0.35
	Area I & IA 1000-2000	3	0.27	0.09	0.46	0.15
	Area III > 2000	3	0.82	0.27	1.41	0.47

Scenario 1: Dose calculated using mean lead concentration in animals
Scenario 2: Dose calculated using mean lead level plus 1 standard deviation
LOAEL: From Table 7
[1] The hazard quotient method compares calculated exposure concentrations to levels which have been shown to cause an ecological effect (Daily intake ÷ Reference dose = Hazard quotient). A hazard quotient greater than 1 indicates that exposure to contaminants at calculated levels may cause deleterious effects.

NLI 002 2284

TABLE 8 (continued). Risk Estimates for Biota Utilizing the NL Industries site

SPECIES	LEAD IN MEDIA (mg/kg)	LOAEL (mg/kg/day)	DAILY INTAKE (SCENARIO 1) (mg/kg/day)	HAZARD QUOTIENT[1]	DAILY INTAKE (SCENARIO 2) (mg/kg/day)	HAZARD QUOTIENT
RED FOX	Area II < 1000	2.5	1.19	0.48	2.25	0.90
	Area I & IA 1000-2000	2.5	1.94	0.78	3.00	1.20
	Area III > 2000	2.5	2.77	1.11	4.54	1.82
MINK, MALE	Area II < 1000	2	2.63	1.32	4.95	2.48
	Area I & IA 1000-2000	2	4.31	2.17	6.80	3.40
	Area III > 2000	2	6.55	3.28	10.57	5.29
MINK, FEMALE	Area II < 1000	2	2.94	1.47	5.47	2.74
	Area I & IA 1000-2000	2	4.82	2.41	7.59	3.80
	Area III > 2000	2	7.27	3.64	11.75	5.88

Scenario 1: Dose calculated using mean lead concentration in animals
Scenario 2: Dose calculated using mean lead level plus 1 standard deviation
LOAEL: From Table 7
[1] The hazard quotient method compares calculated exposure concentrations to levels which have been shown to cause an ecological effect (Daily intake ÷ Reference dose = Hazard quotient). A hazard quotient greater than 1 indicates that exposure to contaminants at calculated levels may cause deleterious effects.

APPENDIX III

ADMINISTRATIVE RECORD INDEX

Document Number: NLI-001-0001 To 0010 Date: / /

Title: Potential Hazardous Waste Site Site Inspection Report - NL Industries Inc.

Type: PLAN
Author: Zervas, David: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-001-0011 To 0108 Date: 05/01/83

Title: Hydrogeologic Study and Design of Ground Water Abatement System at NL Industries Inc., Pedricktown NJ Plant Site

Type: PLAN
Author: none: Geraghty & Miller
Recipient: none: none

Document Number: NLI-001-0109 To 0279 Date: 05/01/87

Title: Work Plan - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Condition: INCOMPLETE; MARGINALIA
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0280 To 0426 Date: 05/01/87

Title: Work Plan - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0427 To 0509 Date: 08/01/87

Title: OBG Laboratories, Inc. QA Program Manual - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0510 To 0537 Parent: NLI-001-0512 Date: 04/01/88

Title: Field Sampling and Analysis Plan - RI/FS Oversight - NL Industries Site, Pedricktown NJ

Type: PLAN
Author: Horzempa, Lewis M: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-0512 To 0513 Date: 05/03/88

Title: (Letter submitting Field Sampling and Analysis Plan)

Type: CORRESPONDENCE
Author: Sachdev, Dev R.: Ebasco Services
Recipient: Alvi, M. Shaheer: US EPA
Attached: NLI-001-0510

Document Number: NLI-001-0538 To 0889 Parent: NLI-001-0539 Date: 05/01/88

Title: Site Operations Plan - Remedial Investigation Plan/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0539 To 0540 Date: 05/10/88

Title: (Letter submitting the Final Site Operations Plan)

Type: CORRESPONDENCE
Condition: MARGINALIA
Author: Holt, Stephan W.: NL Industries, Inc.
Recipient: Donato, Kerwin: US EPA
Attached: NLI-001-0538

Document Number: NLI-001-0890 To 1265 Date: 06/01/90

Title: Technical Memorandum - Data Validation - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Condition: MARGINALIA
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-1266 To 1280 Date: 12/01/90

Title: NL Industries Sediment Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1281 To 1282 Date: 11/01/90

Title: NL Industries Soil Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1283 To 1297 Date: 12/01/90

Title: NL Industries Groundwater Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1298 To 1304 Date: 12/01/90

Title: NL Industries Surface Water Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1305 To 1312 Date: 12/01/90

Title: NL Industries Sediment Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1313 To 1322 Date: 08/01/89

Title: NL Industries Oversight Groundwater Analyses - Phase II

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1323 To 1347 Date: 10/01/88

Title: (Phase I Water and Soil Analyses, Site Maps)

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1348 To 1393 Date: 04/01/90

Title: Final RI Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Condition: MARGINALIA
Author: Rubin, David B: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-1394 To 1673 Date: 10/01/90

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume I: Report, Tables, Figures

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-1674 To 2187 **Date: 10/01/90**

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume II: Appendices, Exhibits

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-2188 To 2319 **Date: 12/01/90**

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume III: Appendices R-U

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-2320 To 2342 **Date: 06/14/90**

Title: (Letter forwarding the revised RI Oversight Summary Report)

Type: CORRESPONDENCE
Author: Rubin, David B: Ebasco Services
Recipient: Gilbert, Michael H: US EPA
Attached: NLI-001-2323

Document Number: NLI-001-2323 To 2342 **Parent: NLI-001-2320** **Date: 04/01/90**

Title: Final RI Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Author: Rubin, David B: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-2343 To 2354 **Date: 07/19/90**

Title: (Letter forwarding attached summary comparison of USEPA and NL Industries data for the Phase II split samples)

Type: CORRESPONDENCE
Author: Rubin, David B: Ebasco Services
Recipient: Gilbert, Michael H: US EPA

Document Number: NLI-001-2355 To 2358 Date: 09/19/90

Title: (Letter indicating need for additional sampling at the site)

Type: CORRESPONDENCE
Condition: MARGINALIA
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2359 To 2361 Date: 10/05/90

Title: (Letter requesting retesting of soils and rejecting request for extension for submittal of RI Report)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2362 To 2365 Date: 11/15/90

Title: (Letter conveying approval of the amended Sampling Plan and outlining methods for sample collecting and analysis)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2366 To 2367 Date: 11/26/90

Title: (Letter outlining analysis guidelines)

Type: CORRESPONDENCE
Author: Gilbert, Michael H: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2368 To 2370 Date: 11/29/90

Title: (Letter stating EPA's intention to take and analyze samples from the site)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2371 To 2373 Date: 03/06/91

Title: (Letter requesting changes in the 10/90 Remedial Investigation Report)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2374 To 2385 Date: 04/23/91

Title: (Letter forwarding attached information pertaining to wells at the site)

Type: CORRESPONDENCE
Author: Holt, Stephen W: NL Industries, Inc.
Recipient: Kothari, Dilip: Ebasco Services

Document Number: NLI-001-2386 To 2390 Date: 04/10/89

Title: Preliminary Health Assessment for NL Industries

Type: PLAN
Author: none: Agency for Toxic Substances & Disease Registry (ATSDR)
Recipient: none: none

Document Number: NLI-001-2391 To 2391 Date: 02/28/91

Title: (Letter stating that NL Industries will have to close the underground storage tanks at the site)

Type: CORRESPONDENCE
Condition: MISSING ATTACHMENT
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H: US EPA

Document Number: NLI-001-2392 To 2392 Date: / /

Title: (List of EPA Guidance Publications)

Type:
Author: none: none
Recipient: none: none

Document Number: NLI-001-2393 To 2393 Date: 08/20/90

Title: (Letter requesting applicable or relevant requirements which pertain to the site)

Type: CORRESPONDENCE
Author: Gilbert, Michael H.: US EPA
Recipient: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)

Document Number: NLI-001-2394 To 2394 Date: 10/15/90

Title: (Letter regarding applicable or relevant requirements for testing at the site)

Type: CORRESPONDENCE
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H.: US EPA
Attached: NLI-001-2409

Document Number: NLI-001-2395 To 2408 Date: 11/27/90

Title: (Referral form forwarding attached surface water ARARs for the site)

Type: CORRESPONDENCE
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H.: US EPA

Document Number: NLI-001-2409 To 2412 Parent: NLI-001-2394 Date: 03/01/88

Title: Regulations Implementing the New Jersey Water Pollution Control Act

Type: LEGAL DOCUMENT
Author: none: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-002-0001 To 0119 Date: 09/01/90

Title: Regulations Implementing the New Jersey Underground Storage of Hazardous Substances Act

Type: LEGAL DOCUMENT
Author: none: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-002-0120 To 0162 Date: / /

Title: NJDEP Fresh Water Permit Application

Type: OTHER
Author: none: none
Recipient: none: none

Document Number: NLI-002-0163 To 0185 Date: 12/01/86

Title: Final Community Relations Plan - NL Industries Site, Pedricktown, NJ

Type: PLAN
Author: Diamond, Christopher R.: ICF Incorporated
Recipient: none: US EPA

Document Number: NLI-002-0186 To 0208 Parent: NLI-002-0188 Date: 01/01/89

Title: Final Public Information Meeting Summary for the NL Industries Site, Redricktown, NJ

Type: PLAN
Author: Manning, Kathleen S.: ICF Incorporated
Recipient: none: US EPA

Document Number: NLI-002-0188 To 0189 Date: 01/23/89

Title: (Letter submitting the Final Public Information Meeting Summary)

Type: CORRESPONDENCE
Author: Sachdev, Dev R.: Ebasco Services
Recipient: Johnson, Lillian: US EPA
Attached: NLI-002-0186

Document Number: NLI-002-0209 To 0219 Date: 01/01/91

Title: Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Author: none: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-002-0220 To 0261 Date: 01/01/92

Title: A Stage 1A Cultural Resources Survey of the NSNJ/NL Property, Oldmans Township, Salem County NJ

Type: PLAN
Author: Crist, Thomas A.J.: John Milner Associates
McCarthy, John P.: John Milner Associates
Recipient: none: O'Brien & Gere
none: NL Industries, Inc.

Document Number: NLI-002-0262 To 0363 Date: 03/01/91

Title: Volume IV, Appendices V-W, Remedial Investigation National Smelting of New Jersey, Inc./NL Industries, Inc. Site, Pedricktown, New Jersey

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: none

Document Number: NLI-002-0364 To 0367 Parent: NLI-002-2078 Date: 07/08/91

Title: (Letter approving the Remedial Investigation (RI) Report, Volumes I-IV for the NL Industries, Inc., site, in conjunction with EPA's enclosed RI Addendum, and approving the Feasibility Study Workplan with modifications specified in the letter.)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W.: NL Industries, Inc.

Document Number: NLI-002-0368 To 0375 Parent: NLI-002-2078 Date: / /

Title: Addendum to the Remedial Investigation, Volumes I-IV, NL Industries, Inc., Superfund Site, Pedricktown, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-0376 To 0428 Date: 07/01/93

Title: Addendum to the Final Feasibility Study Report, NL Industries, Inc. Superfund Site, Operable Unit One, Pedricktown, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-0429 To 0521 Date: 02/01/93

Title: Final Report, TCLP Screening, National Lead Industries Site, Pedricktown, NJ

Type: REPORT
Author: Bovitz, Paul: Environmental Response Team (ERT)
Sprenger, Mark D.: Environmental Response Team (ERT)
Recipient: none: none

Document Number: NLI-002-0522 To 0556 Date: 02/15/93

Title: Stage IB Cultural Resources Survey, National Smelting of New Jersey Property, Oldmans Township, Salem County, New Jersey

Type: PLAN
Author: Grubb, Richard C.: Richard Grubb & Associates, Inc.
Harmon, James M.: Richard Grubb & Associates, Inc.
Recipient: none: O'Brien & Gere

Document Number: NLI-002-0557 To 0557 Date: 05/12/93

Title: (Letter forwarding the "Final Feasibility Study Report," which addresses EPA's comments on the "Draft Feasibility Study Report for the Pedricktown site.")

Type: CORRESPONDENCE
Author: Caracciolo, Angelo J. III: O'Brien & Gere
Recipient: Gilbert, Michael: US EPA
Attached: NLI-002-0558

Document Number: NLI-002-0558 To 1129 Parent: NLI-002-0557 Date: 05/01/93

Title: Final Feasibility Study, NL Industries, Inc. Site, Pedricktown, New Jersey

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: US EPA

Document Number: NLI-002-1130 To 1228 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ

Type: REPORT
Author: Bovitz, Paul: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1229 To 1604 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices A to E

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1605 To 1899 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices F to L

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1900 To 1965 Date: 06/01/93

Title: Final Report, National Lead Industries, Pedricktown, New Jersey, Ecological Risk Assessment

Type: REPORT
Author: Grossman, Scott: ERT
Kracko, Karen: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1966 To 1972 Date: 06/01/93

Title: Final Report, Recommendations for Ecologically Based Lead Remedial Goals, National Lead Industries, Pedricktown, New Jersey

Type: REPORT
Author: Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1973 To 1973 Date: 06/25/93

Title: (Memo containing comments on the May 1993 Final Feasibility Study Report for the NL Industries site)

Type: CORRESPONDENCE
Author: Prendergast, John: New Jersey Department of Environmental Protection and Energy
Recipient: Harvey, Paul: New Jersey Department of Environmental Protection and Energy
Attached: NLI-002-1974

Document Number: NLI-002-1974 To 1974 Parent: NLI-002-1973 Date: 05/24/93

Title: (Memo stating that the NL Draft Feasibility Study has satisfactorily addressed Comments 1 and 2, which were mentioned in a February 9, 1993, memo)

Type: CORRESPONDENCE
Condition: MISSING ATTACHMENT
Author: Kaplan, David M.: New Jersey Department of Environmental Protection and Energy
Recipient: none: New Jersey Department of Environmental Protection and Energy

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Document Number: NLI-002-1975 To 1994 Date: 07/01/93

Title: Superfund Proposed Plan, NL Industries, Inc. Operable Unit One, Pedricktown, Salem County, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-1995 To 2012 Date: 07/14/93

Title: (Action Memorandum requesting a ceiling increase and a removal action restart at the National Lead Industries Inc., Site, Pedricktown, Salem County, New Jersey)

Type: CORRESPONDENCE
Author: Dominach, Eugene: US EPA
Recipient: Muszynski, William J.: US EPA

Document Number: NLI-002-2013 To 2013 Date: 07/16/93

Title: (Letter responding to Mr. Gilbert's request regarding the potential routing and feasibility of the construction of a pipeline to the Delaware River)

Type: CORRESPONDENCE
Author: Holt, Stephen W.: NL Industries, Inc.
Recipient: Gilbert, Michael: US EPA

Document Number: NLI-002-2014 To 2060 Date: 12/01/90

Title: NL Industries, Sediment Analyses, Phase III Nov., Dec. 1990

Type: FINANCIAL/TECHNICAL
Author: none: Ebasco Services
none: O'Brien & Gere
Recipient: none: none

Document Number: NLI-002-2061 To 2073 Date: 01/01/91

Title: Oversight Summary Report - NL Industries Site, Pedricktown, New Jersey

Type: REPORT
Condition: DRAFT; MARGINALIA
Author: Rubin, David B.: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-002-2074 To 2077 Date: 06/20/91

Title: (Letter indicating that the inorganic analyses for groundwater have misreported units.)

Type: CORRESPONDENCE
Author: Hale, Frank D.: O'Brien & Gere
Recipient: Holt, Stephen W.: NL Industries, Inc.

Document Number: NLI-002-2078 To 2078 Date: 08/13/91

Title: (Letter forwarding the revised results of the Phase III oversight samples and indicating that the units on the groundwater analysis have been revised.)

Type: CORRESPONDENCE
Author: Gilbert, Michael H.: US EPA
Recipient: Holt, Stephen W.: NL Industries, Inc.
Attached: NLI-002-0364 NLI-002-0368

Document Number: NLI-002-2079 To 2175 Date: 08/02/93

Title: Transcript of Proceedings - In the Matter of: Superfund Proposed Plan, NL Industries, Inc., Pedricktown, N.J.

Type: LEGAL DOCUMENT
Author: Butler, Virginia E.: Accurate Court Reporting Services
Recipient: none: none

Document Number: NLI-002-2176 To 2200 Date: 02/02/94

Title: (Memo forwarding the attached project summary for the Acid Extraction Treatment System and several sections from the final report detailing the Pedricktown soil)

Type: CORRESPONDENCE
Author: Paff, Stephen W.: Center for Hazardous Materials Research - (Univ. of Pittsburgh)
Recipient: Gilbert, Mick: US EPA

Document Number: NLI-001-0001 To 0010 Date: / /

Title: Potential Hazardous Waste Site Site Inspection Report - NL Industries Inc.

Type: PLAN
Author: Zervas, David: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-001-2392 To 2392 Date: / /

Title: (List of EPA Guidance Publications)

Type:
Author: none: none
Recipient: none: none

Document Number: NLI-002-0120 To 0162 Date: / /

Title: NJDEP Fresh Water Permit Application

Type: OTHER
Author: none: none
Recipient: none: none

Document Number: NLI-002-0368 To 0375 Parent: NLI-002-2078 Date: / /

Title: Addendum to the Remedial Investigation, Volumes I-IV, NL Industries, Inc., Superfund Site, Pedricktown, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-001-0011 To 0108 Date: 05/01/83

Title: Hydrogeologic Study and Design of Ground Water Abatement System at NL Industries Inc., Pedricktown NJ Plant Site

Type: PLAN
Author: none: Geraghty & Miller
Recipient: none: none

Document Number: NLI-002-0163 To 0185 **Date:** 12/01/86

Title: Final Community Relations Plan - NL Industries Site, Pedricktown, NJ

Type: PLAN
Author: Diamond, Christopher R.: ICF Incorporated
Recipient: none: US EPA

Document Number: NLI-001-0109 To 0279 **Date:** 05/01/87

Title: Work Plan - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Condition: INCOMPLETE; MARGINALIA
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0280 To 0426 **Date:** 05/01/87

Title: Work Plan - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0427 To 0509 **Date:** 08/01/87

Title: OBG Laboratories, Inc. QA Program Manual - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-2409 To 2412 Parent: NLI-001-2394 Date: 03/01/88

Title: Regulations Implementing the New Jersey Water Pollution Control Act

Type: LEGAL DOCUMENT
Author: none: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-001-0510 To 0537 Parent: NLI-001-0512 Date: 04/01/88

Title: Field Sampling and Analysis Plan - RI/FS Oversight - NL Industries Site, Pedricktown NJ

Type: PLAN
Author: Horzempa, Lewis M: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-0538 To 0889 Parent: NLI-001-0539 Date: 05/01/88

Title: Site Operations Plan - Remedial Investigation Plan/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0512 To 0513 Date: 05/03/88

Title: (Letter submitting Field Sampling and Analysis Plan)

Type: CORRESPONDENCE
Author: Sachdev, Dev R.: Ebasco Services
Recipient: Alvi, M. Shaheer: US EPA
Attached: NLI-001-0510

Document Number: NLI-001-0539 To 0540 Date: 05/10/88

Title: (Letter submitting the Final Site Operations Plan)

Type: CORRESPONDENCE
Condition: MARGINALIA
Author: Holt, Stephan W.: NL Industries, Inc.
Recipient: Donato, Kerwin: US EPA
Attached: NLI-001-0538

Document Number: NLI-001-1323 To 1347 Date: 10/01/88

Title: (Phase I Water and Soil Analyses, Site Maps)

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-002-0186 To 0208 Parent: NLI-002-0188 Date: 01/01/89

Title: Final Public Information Meeting Summary for the NL Industries Site, Redricktown, NJ

Type: PLAN
Author: Manning, Kathleen S.: ICF Incorporated
Recipient: none: US EPA

Document Number: NLI-002-0188 To 0189 Date: 01/23/89

Title: (Letter submitting the Final Public Information Meeting Summary)

Type: CORRESPONDENCE
Author: Sachdev, Dev R.: Ebasco Services
Recipient: Johnson, Lillian: US EPA
Attached: NLI-002-0186

Document Number: NLI-001-2386 To 2390 Date: 04/10/89

Title: Preliminary Health Assessment for NL Industries

Type: PLAN
Author: none: Agency for Toxic Substances & Disease Registry (ATSDR)
Recipient: none: none

Document Number: NLI-001-1313 To 1322 Date: 08/01/89

Title: NL Industries Oversight Groundwater Analyses - Phase II

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1348 To 1393 Date: 04/01/90

Title: Final RI Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Condition: MARGINALIA
Author: Rubin, David B: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-2323 To 2342 Parent: NLI-001-2320 Date: 04/01/90

Title: Final RI Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Author: Rubin, David B: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-0890 To 1265 Date: 06/01/90

Title: Technical Memorandum - Data Validation - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Condition: MARGINALIA
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-2320 To 2342 Date: 06/14/90

Title: (Letter forwarding the revised RI Oversight Summary Report)

Type: CORRESPONDENCE
Author: Rubin, David B: Ebasco Services
Recipient: Gilbert, Michael H: US EPA
Attached: NLI-001-2323

Document Number: NLI-001-2343 To 2354 Date: 07/19/90

Title: (Letter forwarding attached summary comparison of USEPA and NL Industries data for the Phase II split samples)

Type: CORRESPONDENCE
Author: Rubin, David B: Ebasco Services
Recipient: Gilbert, Michael H: US EPA

Document Number: NLI-001-2393 To 2393 Date: 08/20/90

Title: (Letter requesting applicable or relevant requirements which pertain to the site)

Type: CORRESPONDENCE
Author: Gilbert, Michael H.: US EPA
Recipient: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)

Document Number: NLI-002-0001 To 0119 Date: 09/01/90

Title: Regulations Implementing the New Jersey Underground Storage of Hazardous Substances Act

Type: LEGAL DOCUMENT
Author: none: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-001-2355 To 2358 Date: 09/19/90

Title: (Letter indicating need for additional sampling at the site)

Type: CORRESPONDENCE
Condition: MARGINALIA
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-1394 To 1673 Date: 10/01/90

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume I: Report, Tables, Figures

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-1674 To 2187 Date: 10/01/90

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume II: Appendices, Exhibits

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-2359 To 2361 Date: 10/05/90

Title: (Letter requesting retesting of soils and rejecting request for extension for submittal of RI Report)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2394 To 2394 Date: 10/15/90

Title: (Letter regarding applicable or relevant requirements for testing at the site)

Type: CORRESPONDENCE
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H.: US EPA
Attached: NLI-001-2409

Document Number: NLI-001-1281 To 1282 Date: 11/01/90

Title: NL Industries Soil Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-2362 To 2365 Date: 11/15/90

Title: (Letter conveying approval of the amended Sampling Plan and outlining methods for sample collecting and analysis)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2366 To 2367 Date: 11/26/90

Title: (Letter outlining analysis guidelines)

Type: CORRESPONDENCE
Author: Gilbert, Michael H: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2395 To 2408 Date: 11/27/90

Title: (Referral form forwarding attached surface water ARARs for the site)

Type: CORRESPONDENCE
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H.: US EPA

Document Number: NLI-001-2368 To 2370 Date: 11/29/90

Title: (Letter stating EPA's intention to take and analyze samples from the site)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-1266 To 1280 Date: 12/01/90

Title: NL Industries Sediment Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1283 To 1297 Date: 12/01/90

Title: NL Industries Groundwater Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1298 To 1304 Date: 12/01/90

Title: NL Industries Surface Water Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1305 To 1312 Date: 12/01/90

Title: NL Industries Sediment Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-2188 To 2319 Date: 12/01/90

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume III: Appendices R-U

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-002-2014 To 2060 Date: 12/01/90

Title: NL Industries, Sediment Analyses, Phase III Nov., Dec. 1990

Type: FINANCIAL/TECHNICAL
Author: none: Ebasco Services
none: O'Brien & Gere
Recipient: none: none

Document Number: NLI-002-0209 To 0219 Date: 01/01/91

Title: Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Author: none: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-002-2061 To 2073 Date: 01/01/91

Title: Oversight Summary Report - NL Industries Site, Pedricktown, New Jersey

Type: REPORT
Condition: DRAFT; MARGINALIA
Author: Rubin, David B.: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-2391 To 2391 Date: 02/28/91

Title: (Letter stating that NL Industries will have to close the underground storage tanks at the site)

Type: CORRESPONDENCE
Condition: MISSING ATTACHMENT
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H: US EPA

Document Number: NLI-002-0262 To 0363 Date: 03/01/91

Title: Volume IV, Appendices V-W, Remedial Investigation National Smelting of New Jersey, Inc./NL Industries, Inc. Site, Pedricktown, New Jersey

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: none

Document Number: NLI-001-2371 To 2373 Date: 03/06/91

Title: (Letter requesting changes in the 10/90 Remedial Investigation Report)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2374 To 2385 Date: 04/23/91

Title: (Letter forwarding attached information pertaining to wells at the site)

Type: CORRESPONDENCE
Author: Holt, Stephen W: NL Industries, Inc.
Recipient: Kothari, Dilip: Ebasco Services

Document Number: NLI-002-2074 To 2077 Date: 06/20/91

Title: (Letter indicating that the inorganic analyses for groundwater have misreported units.)

Type: CORRESPONDENCE
Author: Hale, Frank D.: O'Brien & Gere
Recipient: Holt, Stephen W.: NL Industries, Inc.

Document Number: NLI-002-0364 To 0367 Parent: NLI-002-2078 Date: 07/08/91

Title: (Letter approving the Remedial Investigation (RI) Report, Volumes I-IV for the NL Industries, Inc., site, in conjunction with EPA's enclosed RI Addendum, and approving the Feasibility Study Workplan with modifications specified in the letter.)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W.: NL Industries, Inc.

Document Number: NLI-002-2078 To 2078 Date: 08/13/91

Title: (Letter forwarding the revised results of the Phase III oversight samples and indicating that the units on the groundwater analysis have been revised.)

Type: CORRESPONDENCE
Author: Gilbert, Michael H.: US EPA
Recipient: Holt, Stephen W.: NL Industries, Inc.
Attached: NLI-002-0364 NLI-002-0368

Document Number: NLI-002-0220 To 0261 Date: 01/01/92

Title: A Stage 1A Cultural Resources Survey of the NSNJ/NL Property, Oldmans Township, Salem County NJ

Type: PLAN
Author: Crist, Thomas A.J.: John Milner Associates
McCarthy, John P.: John Milner Associates
Recipient: none: O'Brien & Gere
none: NL Industries, Inc.

Document Number: NLI-002-0429 To 0521 **Date:** 02/01/93

Title: Final Report, TCLP Screening, National Lead Industries Site, Pedricktown, NJ

Type: REPORT
Author: Bovitz, Paul: Environmental Response Team (ERT)
Sprenger, Mark D.: Environmental Response Team (ERT)
Recipient: none: none

Document Number: NLI-002-0522 To 0556 **Date:** 02/15/93

Title: Stage IB Cultural Resources Survey, National Smelting of New Jersey Property, Oldmans Township, Salem County, New Jersey

Type: PLAN
Author: Grubb, Richard C.: Richard Grubb & Associates, Inc.
Harmon, James M.: Richard Grubb & Associates, Inc.
Recipient: none: O'Brien & Gere

Document Number: NLI-002-0558 To 1129 **Parent:** NLI-002-0557 **Date:** 05/01/93

Title: Final Feasibility Study, NL Industries, Inc. Site, Pedricktown, New Jersey

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: US EPA

Document Number: NLI-002-0557 To 0557 **Date:** 05/12/93

Title: (Letter forwarding the "Final Feasibility Study Report," which addresses EPA's comments on the "Draft Feasibility Study Report for the Pedricktown site.")

Type: CORRESPONDENCE
Author: Caracciolo, Angelo J. III: O'Brien & Gere
Recipient: Gilbert, Michael: US EPA
Attached: NLI-002-0558

Document Number: NLI-002-1974 To 1974 Parent: NLI-002-1973 Date: 05/24/93

Title: (Memo stating that the NL Draft Feasibility Study has satisfactorily addressed Comments 1 and 2, which were mentioned in a February 9, 1993, memo)

Type: CORRESPONDENCE
Condition: MISSING ATTACHMENT
Author: Kaplan, David M.: New Jersey Department of Environmental Protection and Energy
Recipient: none: New Jersey Department of Environmental Protection and Energy

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Document Number: NLI-002-1130 To 1228 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ

Type: REPORT
Author: Bovitz, Paul: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1229 To 1604 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices A to E

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1605 To 1899 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices F to L

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1900 To 1965 Date: 06/01/93

Title: Final Report, National Lead Industries, Pedricktown, New Jersey, Ecological Risk Assessment

Type: REPORT
Author: Grossman, Scott: ERT
Kracko, Karen: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1966 To 1972 Date: 06/01/93

Title: Final Report, Recommendations for Ecologically Based Lead Remedial Goals, National Lead Industries, Pedricktown, New Jersey

Type: REPORT
Author: Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1973 To 1973 Date: 06/25/93

Title: (Memo containing comments on the May 1993 Final Feasibility Study Report for the NL Industries site)

Type: CORRESPONDENCE
Author: Prendergast, John: New Jersey Department of Environmental Protection and Energy
Recipient: Harvey, Paul: New Jersey Department of Environmental Protection and Energy
Attached: NLI-002-1974

Document Number: NLI-002-0376 To 0428 Date: 07/01/93

Title: Addendum to the Final Feasibility Study Report, NL Industries, Inc. Superfund Site, Operable Unit One, Pedricktown, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-1975 To 1994 Date: 07/01/93

Title: Superfund Proposed Plan, NL Industries, Inc. Operable Unit One, Pedricktown, Salem County, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-1995 To 2012 Date: 07/14/93

Title: (Action Memorandum requesting a ceiling increase and a removal action restart at the National Lead Industries Inc., Site, Pedricktown, Salem County, New Jersey)

Type: CORRESPONDENCE
Author: Dominach, Eugene: US EPA
Recipient: Muszynski, William J.: US EPA

Document Number: NLI-002-2013 To 2013 Date: 07/16/93

Title: (Letter responding to Mr. Gilbert's request regarding the potential routing and feasibility of the construction of a pipeline to the Delaware River)

Type: CORRESPONDENCE
Author: Holt, Stephen W.: NL Industries, Inc.
Recipient: Gilbert, Michael: US EPA

Document Number: NLI-002-2079 To 2175 Date: 08/02/93

Title: Transcript of Proceedings - In the Matter of: Superfund Proposed Plan, NL Industries, Inc., Pedricktown, N.J.

Type: LEGAL DOCUMENT
Author: Butler, Virginia E.: Accurate Court Reporting Services
Recipient: none: none

Document Number: NLI-002-2176 To 2200 Date: 02/02/94

Title: (Memo forwarding the attached project summary for the Acid Extraction Treatment System and several sections from the final report detailing the Pedricktown soil)

Type: CORRESPONDENCE
Author: Paff, Stephen W.: Center for Hazardous Materials Research - (Univ. of Pittsburgh)
Recipient: Gilbert, Nick: US EPA

Document Number: NLI-001-1266 To 1280 Date: 12/01/90

Title: NL Industries Sediment Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1281 To 1282 Date: 11/01/90

Title: NL Industries Soil Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1283 To 1297 Date: 12/01/90

Title: NL Industries Groundwater Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1298 To 1304 Date: 12/01/90

Title: NL Industries Surface Water Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1305 To 1312 Date: 12/01/90

Title: NL Industries Sediment Analyses - Phase III

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1313 To 1322 Date: 08/01/89

Title: NL Industries Oversight Groundwater Analyses - Phase II

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-1323 To 1347 Date: 10/01/88

Title: (Phase I Water and Soil Analyses, Site Maps)

Type: DATA
Author: none: none
Recipient: none: none

Document Number: NLI-001-2392 To 2392 Date: / /

Title: (List of EPA Guidance Publications)

Type:
Author: none: none
Recipient: none: none

Document Number: NLI-002-0120 To 0162 Date: / /

Title: NJDEP Fresh Water Permit Application

Type: OTHER
Author: none: none
Recipient: none: none

Document Number: NLI-001-0011 To 0108 Date: 05/01/83

Title: Hydrogeologic Study and Design of Ground Water Abatement System at NL Industries Inc., Pedricktown NJ Plant Site

Type: PLAN
Author: none: Geraghty & Miller
Recipient: none: none

Document Number: NLI-001-0109 To 0279 Date: 05/01/87

Title: Work Plan - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Condition: INCOMPLETE; MARGINALIA
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0280 To 0426 Date: 05/01/87

Title: Work Plan - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0427 To 0509 Date: 08/01/87

Title: OBG Laboratories, Inc. QA Program Manual - Remedial Investigation/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0538 To 0889 Parent: NLI-001-0539 Date: 05/01/88

Title: Site Operations Plan - Remedial Investigation Plan/Feasibility Study - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-0890 To 1265 Date: 06/01/90

Title: Technical Memorandum - Data Validation - National Smelting of NJ Site, Pedricktown NJ

Type: PLAN
Condition: MARGINALIA
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-1394 To 1673 Date: 10/01/90

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume I: Report, Tables, Figures

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-1674 To 2187 Date: 10/01/90

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume II: Appendices, Exhibits

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-2188 To 2319 Date: 12/01/90

Title: Remedial Investigation - National Smelting of NJ/NL Industries Site Volume III: Appendices R-U

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: NL Industries, Inc.

Document Number: NLI-001-2386 To 2390 Date: 04/10/89

Title: Preliminary Health Assessment for NL Industries

Type: PLAN
Author: none: Agency for Toxic Substances & Disease Registry (ATSDR)
Recipient: none: none

Document Number: NLI-001-2409 To 2412 Parent: NLI-001-2394 Date: 03/01/88

Title: Regulations Implementing the New Jersey Water Pollution Control Act

Type: LEGAL DOCUMENT
Author: none: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-002-0001 To 0119 Date: 09/01/90

Title: Regulations Implementing the New Jersey Underground Storage of Hazardous Substances Act

Type: LEGAL DOCUMENT
Author: none: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

Document Number: NLI-002-0209 To 0219 Date: 01/01/91

Title: Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Author: none: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-002-0262 To 0363 Date: 03/01/91

Title: Volume IV, Appendices V-W, Remedial Investigation National Smelting of New Jersey, Inc./NL Industries, Inc. Site, Pedricktown, New Jersey

Type: PLAN
Author: none: O'Brien & Gere
Recipient: none: none

Document Number: NLI-002-0368 To 0375 Parent: NLI-002-2078 Date: / /

Title: Addendum to the Remedial Investigation, Volumes I-IV, NL Industries, Inc., Superfund Site, Pedricktown, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-0376 To 0428 Date: 07/01/93

Title: Addendum to the Final Feasibility Study Report, NL Industries, Inc. Superfund Site, Operable Unit One, Pedricktown, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-0558 To 1129 Parent: NLI-002-0557 Date: 05/01/93

Title: Final Feasibility Study, NL Industries, Inc. Site, Pedricktown, New Jersey

Type: REPORT
Author: none: O'Brien & Gere
Recipient: none: US EPA

Document Number: NLI-002-1975 To 1994 Date: 07/01/93

Title: Superfund Proposed Plan, NL Industries, Inc. Operable Unit One, Pedricktown, Salem County, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: NLI-002-2014 To 2060 Date: 12/01/90

Title: NL Industries, Sediment Analyses, Phase III Nov., Dec. 1990

Type: FINANCIAL/TECHNICAL
Author: none: Ebasco Services
none: O'Brien & Gere
Recipient: none: none

Document Number: NLI-002-2014 To 2060 Date: 12/01/90

Title: NL Industries, Sediment Analyses, Phase III Nov., Dec. 1990

Type: FINANCIAL/TECHNICAL
Author: none: Ebasco Services
none: O'Brien & Gere
Recipient: none: none

Document Number: NLI-001-2355 To 2358 Date: 09/19/90

Title: (Letter indicating need for additional sampling at the site)

Type: CORRESPONDENCE
Condition: MARGINALIA
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2359 To 2361 Date: 10/05/90

Title: (Letter requesting retesting of soils and rejecting request for extension for submittal of RI Report)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2362 To 2365 Date: 11/15/90

Title: (Letter conveying approval of the amended Sampling Plan and outlining methods for sample collecting and analysis)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2368 To 2370 Date: 11/29/90

Title: (Letter stating EPA's intention to take and analyze samples from the site)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2371 To 2373 Date: 03/06/91

Title: (Letter requesting changes in the 10/90 Remedial Investigation Report)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-002-0364 To 0367 Parent: NLI-002-2078 Date: 07/08/91

Title: (Letter approving the Remedial Investigation (RI) Report, Volumes I-IV for the NL Industries, Inc., site, in conjunction with EPA's enclosed RI Addendum, and approving the Feasibility Study Workplan with modifications specified in the letter.)

Type: CORRESPONDENCE
Author: Basso, Raymond: US EPA
Recipient: Holt, Stephen W.: NL Industries, Inc.

Document Number: NLI-002-0429 To 0521 Date: 02/01/93

Title: Final Report, TCLP Screening, National Lead Industries Site, Pedricktown, NJ

Type: REPORT
Author: Bovitz, Paul: Environmental Response Team (ERT)
Sprenger, Mark D.: Environmental Response Team (ERT)
Recipient: none: none

Document Number: NLI-002-1130 To 1228 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ

Type: REPORT
Author: Bovitz, Paul: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-2079 To 2175 Date: 08/02/93

Title: Transcript of Proceedings - In the Matter of: Superfund Proposed Plan, NL Industries, Inc., Pedricktown, N.J.

Type: LEGAL DOCUMENT
Author: Butler, Virginia E.: Accurate Court Reporting Services
Recipient: none: none

Document Number: NLI-002-0557 To 0557 Date: 05/12/93

Title: (Letter forwarding the "Final Feasibility Study Report," which addresses EPA's comments on the "Draft Feasibility Study Report for the Pedricktown site.")

Type: CORRESPONDENCE
Author: Caracciolo, Angelo J. III: O'Brien & Gere
Recipient: Gilbert, Michael: US EPA
Attached: NLI-002-0558

Document Number: NLI-002-0220 To 0261 Date: 01/01/92

Title: A Stage 1A Cultural Resources Survey of the NSNJ/NL Property, Oldmans Township, Salem County NJ

Type: PLAN
Author: Crist, Thomas A.J.: John Milner Associates
McCarthy, John P.: John Milner Associates
Recipient: none: O'Brien & Gere
none: NL Industries, Inc.

Document Number: NLI-002-0163 To 0185 Date: 12/01/86

Title: Final Community Relations Plan - NL Industries Site, Pedricktown, NJ

Type: PLAN
Author: Diamond, Christopher R.: ICF Incorporated
Recipient: none: US EPA

Document Number: NLI-002-1995 To 2012 Date: 07/14/93

Title: (Action Memorandum requesting a ceiling increase and a removal action restart at the National Lead Industries Inc., Site, Pedricktown, Salem County, New Jersey)

Type: CORRESPONDENCE
Author: Dominach, Eugene: US EPA
Recipient: Muszynski, William J.: US EPA

Document Number: NLI-001-2366 To 2367 Date: 11/26/90

Title: (Letter outlining analysis guidelines)

Type: CORRESPONDENCE
Author: Gilbert, Michael H: US EPA
Recipient: Holt, Stephen W: NL Industries, Inc.

Document Number: NLI-001-2393 To 2393 Date: 08/20/90

Title: (Letter requesting applicable or relevant requirements which pertain to the site)

Type: CORRESPONDENCE
Author: Gilbert, Michael H.: US EPA
Recipient: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)

Document Number: NLI-002-2078 To 2078 Date: 08/13/91

Title: (Letter forwarding the revised results of the Phase III oversight samples and indicating that the units on the groundwater analysis have been revised.)

Type: CORRESPONDENCE
Author: Gilbert, Michael H.: US EPA
Recipient: Holt, Stephen W.: NL Industries, Inc.
Attached: NLI-002-0364 NLI-002-0368

Document Number: NLI-002-1900 To 1965 Date: 06/01/93

Title: Final Report, National Lead Industries, Pedricktown, New Jersey, Ecological Risk Assessment

Type: REPORT
Author: Grossman, Scott: ERT
Kracko, Karen: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-0522 To 0556 Date: 02/15/93

Title: Stage IB Cultural Resources Survey, National Smelting of New Jersey Property, Oldmans Township, Salem County, New Jersey

Type: PLAN
Author: Grubb, Richard C.: Richard Grubb & Associates, Inc.
Harmon, James M.: Richard Grubb & Associates, Inc.
Recipient: none: O'Brien & Gere

Document Number: NLI-002-2074 To 2077 Date: 06/20/91

Title: (Letter indicating that the inorganic analyses for groundwater have misreported units.)

Type: CORRESPONDENCE
Author: Hale, Frank D.: O'Brien & Gere
Recipient: Holt, Stephen W.: NL Industries, Inc.

Document Number: NLI-002-0522 To 0556 Date: 02/15/93

Title: Stage IB Cultural Resources Survey, National Smelting of New Jersey Property, Oldmans Township, Salem County, New Jersey

Type: PLAN
Author: Grubb, Richard C.: Richard Grubb & Associates, Inc.
Harmon, James M.: Richard Grubb & Associates, Inc.
Recipient: none: O'Brien & Gere

Document Number: NLI-002-1229 To 1604 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices A to E

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1605 To 1899 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices F to L

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-001-2391 To 2391 Date: 02/28/91

Title: (Letter stating that NL Industries will have to close the underground storage tanks at the site)

Type: CORRESPONDENCE
Condition: MISSING ATTACHMENT
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H: US EPA

Document Number: NLI-001-2394 To 2394 Date: 10/15/90

Title: (Letter regarding applicable or relevant requirements for testing at the site)

Type: CORRESPONDENCE
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H.: US EPA
Attached: NLI-001-2409

Document Number: NLI-001-2395 To 2408 Date: 11/27/90

Title: (Referral form forwarding attached surface water ARARs for the site)

Type: CORRESPONDENCE
Author: Holstrom, Christina: NJ Department of Environmental Protection (NJDEP)
Recipient: Gilbert, Michael H.: US EPA

Document Number: NLI-001-0539 To 0540 Date: 05/10/88

Title: (Letter submitting the Final Site Operations Plan)

Type: CORRESPONDENCE
Condition: MARGINALIA
Author: Holt, Stephan W.: NL Industries, Inc.
Recipient: Donato, Kerwin: US EPA
Attached: NLI-001-0538

Document Number: NLI-001-2374 To 2385 Date: 04/23/91

Title: (Letter forwarding attached information pertaining to wells at the site)

Type: CORRESPONDENCE
Author: Holt, Stephen W: NL Industries, Inc.
Recipient: Kothari, Dilip: Ebasco Services

Document Number: NLI-002-2013 To 2013 Date: 07/16/93

Title: (Letter responding to Mr. Gilbert's request regarding the potential routing and feasibility of the construction of a pipeline to the Delaware River)

Type: CORRESPONDENCE
Author: Holt, Stephen W.: NL Industries, Inc.
Recipient: Gilbert, Michael: US EPA

Document Number: NLI-001-0510 To 0537 Parent: NLI-001-0512 Date: 04/01/88

Title: Field Sampling and Analysis Plan - RI/FS Oversight - NL Industries Site, Pedricktown NJ

Type: PLAN
Author: Horzempa, Lewis M: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-002-1974 To 1974 Parent: NLI-002-1973 Date: 05/24/93

Title: (Memo stating that the NL Draft Feasibility Study has satisfactorily addressed Comments 1 and 2, which were mentioned in a February 9, 1993, memo)

Type: CORRESPONDENCE
Condition: MISSING ATTACHMENT
Author: Kaplan, David M.: New Jersey Department of Environmental Protection and Energy
Recipient: none: New Jersey Department of Environmental Protection and Energy

Document Number: NLI-002-1900 To 1965 Date: 06/01/93

Title: Final Report, National Lead Industries, Pedricktown, New Jersey, Ecological Risk Assessment

Type: REPORT
Author: Grossman, Scott: ERT
Kracko, Karen: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-0186 To 0208 Parent: NLI-002-0188 Date: 01/01/89

Title: Final Public Information Meeting Summary for the NL Industries Site, Redricktown, NJ

Type: PLAN
Author: Manning, Kathleen S.: ICF Incorporated
Recipient: none: US EPA

Document Number: NLI-002-0220 To 0261 Date: 01/01/92

Title: A Stage 1A Cultural Resources Survey of the NSNJ/NL Property, Oldmans Township, Salem County NJ

Type: PLAN
Author: Crist, Thomas A.J.: John Milner Associates
McCarthy, John P.: John Milner Associates
Recipient: none: O'Brien & Gere
none: NL Industries, Inc.

Document Number: NLI-002-2176 To 2200 Date: 02/02/94

Title: (Memo forwarding the attached project summary for the Acid Extraction Treatment System and several sections from the final report detailing the Pedricktown soil)

Type: CORRESPONDENCE
Author: Paff, Stephen W.: Center for Hazardous Materials Research - (Univ. of Pittsburgh)
Recipient: Gilbert, Mick: US EPA

Document Number: NLI-002-1973 To 1973 Date: 06/25/93

Title: (Memo containing comments on the May 1993 Final Feasibility Study Report for the NL Industries site)

Type: CORRESPONDENCE
Author: Prendergast, John: New Jersey Department of Environmental Protection and Energy
Recipient: Harvey, Paul: New Jersey Department of Environmental Protection and Energy
Attached: NLI-002-1974

Document Number: NLI-001-1348 To 1393 Date: 04/01/90

Title: Final RI Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Condition: MARGINALIA
Author: Rubin, David B: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-2320 To 2342 Date: 06/14/90

Title: (Letter forwarding the revised RI Oversight Summary Report)

Type: CORRESPONDENCE
Author: Rubin, David B: Ebasco Services
Recipient: Gilbert, Michael H: US EPA
Attached: NLI-001-2323

Document Number: NLI-001-2323 To 2342 Parent: NLI-001-2320 Date: 04/01/90

Title: Final RI Oversight Summary Report - NL Industries Site, Pedricktown NJ

Type: REPORT
Author: Rubin, David B: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-2343 To 2354 Date: 07/19/90

Title: (Letter forwarding attached summary comparison of USEPA and NL Industries data for the Phase II split samples)

Type: CORRESPONDENCE
Author: Rubin, David B: Ebasco Services
Recipient: Gilbert, Michael H: US EPA

Document Number: NLI-002-2061 To 2073 Date: 01/01/91

Title: Oversight Summary Report - NL Industries Site, Pedricktown, New Jersey

Type: REPORT
Condition: DRAFT; MARGINALIA
Author: Rubin, David B.: Ebasco Services
Recipient: none: US EPA

Document Number: NLI-001-0512 To 0513 Date: 05/03/88

Title: (Letter submitting Field Sampling and Analysis Plan)

Type: CORRESPONDENCE
Author: Sachdev, Dev R.: Ebasco Services
Recipient: Alvi, M. Shaheer: US EPA
Attached: NLI-001-0510

Document Number: NLI-002-0188 To 0189 Date: 01/23/89

Title: (Letter submitting the Final Public Information Meeting Summary)

Type: CORRESPONDENCE
Author: Sachdev, Dev R.: Ebasco Services
Recipient: Johnson, Lillian: US EPA
Attached: NLI-002-0186

Document Number: NLI-002-0429 To 0521 Date: 02/01/93

Title: Final Report, TCLP Screening, National Lead Industries Site, Pedricktown, NJ

Type: REPORT
Author: Bovitz, Paul: Environmental Response Team (ERT)
Sprenger, Mark D.: Environmental Response Team (ERT)
Recipient: none: none

Document Number: NLI-002-1130 To 1228 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ

Type: REPORT
Author: Bovitz, Paul: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1229 To 1604 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices A to E

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1605 To 1899 Date: 06/01/93

Title: Final Report, Field Ecological Assessment, National Lead Site, Pedricktown, Salem County, NJ - Appendices F to L

Type: REPORT
Author: Henry, Richard: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1900 To 1965 Date: 06/01/93

Title: Final Report, National Lead Industries, Pedricktown, New Jersey, Ecological Risk Assessment

Type: REPORT
Author: Grossman, Scott: ERT
Kracko, Karen: ERT
Sprenger, Mark D.: ERT
Recipient: none: none

Document Number: NLI-002-1966 To 1972 Date: 06/01/93

Title: Final Report, Recommendations for Ecologically Based Lead Remedial Goals, National Lead Industries, Pedricktown, New Jersey

Type: REPORT
Author: Sprenger, Mark D.: ERT
Recipient: none: none

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Title: Potential Hazardous Waste Site Site Inspection Report - NL Industries Inc.

Type: PLAN
Author: Zervas, David: NJ Department of Environmental Protection (NJDEP)
Recipient: none: none

APPENDIX IV

STATE LETTER OF NON-CONCURRENCE

State of New Jersey
Department of Environmental Protection and Energy

Robert C. Shinn, Jr.
Commissioner

May 18, 1994

Kathleen Callahan, Director
USEPA Region II
Emergency and Remedial Response Division
26 Federal Plaza
New York, NY 10278-0012

Dear Ms. Callahan:

Re: NL Industries, Pedricktown, Draft ROD

This letter concerns the draft Record of Decision (ROD) for the NL Industries site which was submitted to the Department of Environmental Protection and Energy (Department) by cover letter dated February 23, 1994. The Department cannot concur with the selected remedy because environmental use restrictions, as required per P.L. 1993, c. 139, (S-1070), are not included and off-site soils are not appropriately addressed. The Department's residential soil cleanup criterion for lead is 100 mg/kg. This is the level to which the Department would address the off-site soils. Any remedy that does not attain this criterion must include environmental use restrictions. Without the inclusion of use restrictions and the incorporation of the Department's recommendations for off-site soils in the ROD, the Department cannot concur.

Please contact me with questions at (609) 292-1250.

Sincerely,

Lance R. Miller
Assistant Commissioner

APPENDIX V

RESPONSIVENESS SUMMARY

APPENDIX V

RESPONSIVENESS SUMMARY

NL Industries, Inc. Superfund Site

INTRODUCTION

A responsiveness summary is required by Superfund policy. It provides a summary of citizens' comments and concerns received during the public comment period, and the United States Environmental Protection Agency's (EPA's) responses to those comments and concerns. All comments summarized in this document have been considered in EPA's final decision for selection of a remedial alternative for the NL Industries, Inc. site.

OVERVIEW

The public strongly supported EPA taking action to address the various contaminated media at the NL site. The community supported both the ground water and sediment portions of the preferred alterative. The community did not object to the soil and sediment treatment process itself. However, they expressed a preference for treatment of all soil and sediment above the remedial action objective (Soil Alternative-B), rather than the preferred alternative presented in the Proposed Plan (Soil Alternative-D), which includes treatment of only the hazardous portion and on-site landfilling of the non-hazardous portion of the soil and sediment.

BACKGROUND ON COMMUNITY INVOLVEMENT

Pedricktown residents first became aware of potential environmental and public health impacts associated with operations at the NL site in 1975, when the Salem County Department of Health sampled 15 private drinking water wells in the vicinity of the site. One well was found to have elevated lead levels. Several months later, private homes along Benjamin Green Road west of the site were connected to the public water supply. Other early investigative activities performed to assess off-site impacts included an air monitoring program initiated by the New Jersey Department of Environmental Protection and Energy (NJDEPE) in 1977, at which time elevated levels of several airborne contaminants, including lead, were detected.

The NL site was included on the National Priorities List in December 1982. Since that time, EPA has implemented a community relations program in the site area designed to both inform the public of Superfund activities and solicit input from the community regarding their site-related concerns and questions. These efforts have included disseminating printed public information materials and conducting public meetings and information sessions to coincide with technical milestones at the site.

Through the public outreach efforts noted above, EPA has identified several concerns and issues which have been consistently expressed by the community. These concerns and issues are as follows:

- Liability of the Potentially Responsible Parties (PRPs) for conducting and funding site investigations and cleanup
- Plans to periodically monitor area drinking water supplies
- Impact of site activities on area property values
- Potential future uses of the site
- Anticipated schedule for completion of the site cleanup
- Loss of local tax revenue from the site property

SUMMARY OF COMMUNITY RELATIONS ACTIVITIES

The Remedial Investigation (RI) Report, Feasibility Study (FS) Report, and the Proposed Plan for the site were released to the public for comment on July 22, 1993. These documents were made available to the public in the administrative record file at the EPA Docket Room in Region II, New York and the information repositories at the Penns Grove Public Library in Penns Grove, New Jersey. A copy of relevant documents and information have also been sent to the Oldmans Municipal Building in Pedricktown, New Jersey. The notice of availability for the above-referenced documents was published in Today's Sunbeam on July 22, 1993. The public comment period on these documents was held from July 22, 1993 to September 19, 1993.

On August 2, 1993, EPA conducted a public meeting at the Oldmans Middle School, to inform local officials and interested citizens about the Superfund process, to review current and planned remedial activities at the site, and to respond to any questions from area residents and other attendees.

SUMMARY OF COMMENTS AND RESPONSES

The following correspondence (see Attachment A) was received during the public comment period:

- Letter from George Bradford, Mayor of Pedricktown.
- Letter and supporting comments from Janet D. Smith, Associate General Counsel for NL Industries, Inc.

- Letter and supporting comments from Dennis P. Reis, Attorney for Sidley & Austin, submitted on behalf of Allied Signal Inc., AT&T, C&D Charter Power Systems, Inc. Exide Corporation, and Johnson Controls, Inc.

A summary of the comments contained in the above letters and the comments provided by the public at the August 2, 1993 public meeting, along with EPA's and NJDEPE's responses to those comments, follows.

I. Verbal Comments Received During the Public Meeting

A. TECHNICAL COMMENTS ON OPERABLE UNIT TWO

1. **COMMENT:** A resident asked what was used to treat the slag.

   EPA RESPONSE: After exploring a number of treatment methods, EPA decided upon the use of phosphoric acid. Phosphoric acid combines with the lead in the slag to make lead phosphate. Lead phosphate is stable and will not leach at levels which define it as a hazardous waste. Therefore, the slag has been rendered non-hazardous through this treatment and may be disposed of off site at a non-hazardous landfill.

2. **COMMENT:** A resident asked how EPA processed the steel from the site.

   EPA RESPONSE: EPA washed the steel with high-pressure water to remove the dust. It is then visually inspected, loaded into trucks, and shipped to a scrap dealer for recycling.

3. **COMMENT:** A resident asked if the volume of water said to be removed during remediation included water from the landfill?

   EPA RESPONSE: Only landfill leachate is removed from the landfill. This leachate is collected and disposed of at the DuPont Deepwater facility by NL. The standing water which was removed from the site as part of the Operable Unit Two activities consists of accumulated rainwater and water used for decontamination purposes.

4. **COMMENT:** A resident asked if the dust created while structures are being demolished at the site is dangerous.

   EPA RESPONSE: Prior to demolition, dust is removed from buildings with an industrial vacuum. Then, the structures are power-washed with water. During this process, continuous air monitoring is performed. No exceedences of safe air levels have been detected.

5. **COMMENT:** A resident asked who pays for the cleanup.

EPA RESPONSE: To date, the responsible parties have funded the Operable Unit Two cleanup, which is currently underway. EPA has provided oversight of these activities.

B. TECHNICAL COMMENTS ON OPERABLE UNIT ONE

1. **COMMENT:** Mr. Harvey, Case Manager for NJDEPE added to the presentation by commenting that the State of New Jersey concurs with the selected remedy as presented by EPA. However, he added that the State may not agree with the soil lead cleanup criteria of 500 parts per million. He said that the State is in the process of developing criteria for cleanup of lead in soils and therefore it is possible that when the State finalizes its criteria, it may be less than 500 parts per million (ppm).

2. **COMMENT:** A resident reacted to viewing a slide showing the areas to be excavated under soil remediation at the site by asking if all of the areas shown are contaminated.

EPA RESPONSE: EPA indicated that all of the areas shown contain lead above 500 ppm, thus requiring remediation.

3. **COMMENT:** Residents asked how much cost influences the choice of the preferred alternative and if prohibitive cost was the reason for not treating all soils.

EPA RESPONSE: EPA stated that nine evaluation criteria were used to evaluate each alternative. Protectiveness of human health and the environment and cost are two criteria considered in selecting a remedy. Alternative-B (treating all soils and sediments above the remedial action objective) and Alternative-D (treating only the hazardous soil and sediments and landfilling nonhazardous soils and sediments above the remedial action objective) are both protective of human health and the environment. The cost is 22 million dollars for Alternative-B versus 11.5 million dollars for Alternative-D. Based upon EPA's evaluation of all alternatives against the nine criteria, EPA believes that Alternative-D is cost effective relative to Alternative B.

4. **COMMENT:** One resident asked if the planned on-site landfill would be constructed with a liner.

EPA RESPONSE: A liner would underlie the landfill and the landfill would be covered with a geomembrane cap. Soil and vegetation will be added above the cap.

5. **COMMENT:** A resident informed EPA that, although several residential wells were tested, his well had never been tested because he was not at home during the sampling event.

   EPA RESPONSE: EPA responded that it will test the well, and asked the gentleman to give his address and phone number in order to schedule the well sampling.

6. **COMMENT:** A resident asked if there are any plans to take soil samples from residences around the site area?

   EPA RESPONSE: Approximately twelve residential soil samples have been obtained. All are below 500 ppm of lead, which is EPA's risk based cleanup level. Additional soil sampling will take place at the site during the remedial design phase of the project. The exact nature of any additional soil sampling will be determined during remedial design.

C. EXISTING LANDFILL

1. **COMMENT:** A resident asked EPA why the existing landfill is not included in the cleanup project.

   EPA RESPONSE: The existing landfill has a cover consisting of an impermeable membrane and clean soil, which was brought in from off-site sources. The landfill is closed and is regulated by the State of New Jersey. NL is maintaining, operating, securing and performing sampling as necessary under State of New Jersey requirements. In addition, the landfill was studied and monitored as part of the RI/FS for Operable Unit One. At this time, EPA has no indication that the landfill requires remediation. Note that ground water underlying the landfill exceeding cleanup criteria will be remediated.

2. **COMMENT:** A resident asked if the township sees the results of tests sampled from the monitoring wells around the landfill?

   EPA RESPONSE: All data from the monitoring wells are included in the administrative record. A copy of the administrative record is located in the Penns-Grove Public Library, and, as requested at a previous meeting, EPA at the Oldman's Township Municipal Building.

3. **COMMENT:** A resident expressed concern that the landfill may be responsible for contributing to the ground-water contamination of the project site. The same resident asked what is underneath the landfill.

   EPA RESPONSE: Based on results of data collected during EPA's studies at the site, most of the wells around the landfill have yielded results within the drinking water standard. Although there has been some contamination detected underlying the landfill, these wells will continue to be monitored. The preferred alternative will be designed to address all contaminated ground water which is contaminated above drinking water standards.

4. **COMMENT:** A resident asked why the whole site is not being cleaned up.

   EPA RESPONSE: The remedial investigation performed by EPA has determined the nature and extent of contamination throughout the site. The soil, stream sediments, and ground water that are contaminated are the subject of EPA's preferred alternative for the site. Furthermore, EPA has no indication that the closed, on-site landfill, as currently maintained, is posing an unacceptable human health or environmental risk.

5. **COMMENT:** A resident asked what evidence EPA had that no leachate was leaking from the landfill.

   EPA RESPONSE: As part of the RI, EPA has monitored soils, surface water, and ground water in the vicinity of the on-site landfill. This data indicates that elevated levels of arsenic have been detected in one monitoring well adjacent to the landfill, and have generally been decreasing over time. These elevated contaminant levels are believed to have resulted when a portion of the landfill partially collapsed during a severe storm in 1989. Structural modifications to the landfill have been made to prevent this from occurring in the future. If any data is collected which demonstrates that the landfill is not secured, appropriate action will be taken.

6. **COMMENT:** A resident asked if the landfill will be suspected as a source of contamination if during the five-year follow up monitoring, the stream is found to be contaminated.

   EPA RESPONSE: If surface-water contamination is detected after the soils and stream sediments have been remediated, EPA will investigate further to define the source of contamination and will take appropriate action.

7. **COMMENT:** A resident asked if a landfill is supposed to have as many monitoring wells around it as exist at the project site.

   EPA RESPONSE: The landfill is closed and regulated by the State of New Jersey and maintained by NL. There are fourteen monitoring wells which surround the entire landfill.

D. STEAM SEDIMENT CLEANUP

1. **COMMENT:** A resident asked if EPA planned to remove the contaminated sediments from the stream.

   EPA RESPONSE: Within the next few months, EPA will remove contaminated sediments in the West Stream from just north of Penns Grove Pedricktown Road down to Route 130.

2. **COMMENT:** A resident asked how many years EPA would monitor the stream following cleanup.

   EPA RESPONSE: EPA will monitor the stream and the project site for at least five years following completion of the work.

3. **COMMENT:** A resident asked whether stream sediments would be removed prior to operation of the ground-water treatment and discharge system.

   EPA RESPONSE: Stream sediment will be removed first so that contaminants will not migrate further downstream.

4. **COMMENT:** A resident asked whether the stream bed would be returned to its original profile after dredging.

   EPA RESPONSE: EPA is removing contaminated stream sediments and not altering the steam's original profile. Contaminated sediments, in general, lie within one foot of the surface. However, the Salem County Mosquito Commission may choose to change the stream profile for better drainage after completion of EPA's cleanup.

E. CLEANUP SCHEDULE AND REUSE OF LAND

1. **COMMENT:** A resident asked when EPA's work would be done at the project site and at what point the land would be considered usable for something else.

EPA RESPONSE: EPA anticipates that cleanup will take approximately three years from the time of the Record of Decision. This time frame includes completion of the soil and sediment portion of the remedy, and construction of the ground water treatment plant. It is anticipated that the ground water treatment plant will operate on the order of thirty years.

2. **COMMENT:** A resident asked who is responsible for giving approval for reuse of the site property.

   EPA RESPONSE: Following cleanup, the site will go through the process of being removed from the National Priorities Superfund List. EPA may need to treat the ground water for many years. However, once the sediment and soil are cleaned up, a business could conceivably operate on the property while the water treatment is ongoing, provided that the business would not impact the site's ongoing ground-water remediation.

3. **COMMENT:** A resident asked if there is a permit which must be issued in order for the project land to be reused.

   EPA RESPONSE: EPA's intention is to clean the site to a safe level. It is not anticipated that EPA will impose any land use restrictions on the property after the cleanup is completed.

4. **COMMENT:** A resident expressed concern that the state might override the townships' wishes not to allow National Smelting to operate again in that location.

   EPA RESPONSE: EPA's responsibility is to clean up a site. It does not have any zoning authority. EPA also added that the demolition of the smelting facility is nearly complete, and neither the structure nor equipment will remain at the site.

5. **COMMENT:** A resident expressed concern that the property would not be returned to the tax rolls as long as the landfill was present on the site.

   EPA RESPONSE: Although the portion of the property north of the railroad tracks would have limited use due to the existing landfill, it should have little or no impact upon the future use of the property south of the railroad tracks (the former industrial area).

II. Written Comment Received During the Public Comment Period

Comments received by EPA during the public comment period for the NL site are compiled in this section and are immediately followed by EPA's responses.

A. REMEDIAL ACTION OBJECTIVE FOR SOIL AND SEDIMENT

1. **COMMENT:** Since the 500 to 1,000 ppm cleanup range for lead in soils established by EPA's Interim Guidance is a recommendation for residential settings, it does not apply to the Pedricktown site, an industrial property, where children are not found.

   EPA RESPONSE: The property comprising the NL site is zoned as an industrial property. While a cleanup range of 500 to 1,000 ppm for lead in soils is recommended in EPA's Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund sites for residential properties, EPA's selection of the 500 ppm cleanup level of lead in soils and sediments was based primarily upon an Ecological Risk Assessment performed by EPA at the NL site.

   An Ecological Risk Assessment for the site was performed to develop a cleanup level which would provide an acceptable degree of protection to ecological receptors. During the study, lower species in the food chain (earthworms) were exposed to varying concentrations of lead-contaminated soil. The earthworms bioaccumulated lead from the contaminated soil. The amount of lead in the earthworms was then used to extrapolate (via a mathematical model of the food chain) how much lead would accumulate in receptor species which fed upon the earthworms. The risk was then calculated for each receptor. The results were evaluated and used to define a concentration of lead which would pose an acceptable level of risk to receptor species. This concentration is 500 ppm of lead in soils and sediments at the NL site.

   The cleanup level was developed for ecologically sensitive areas of the site where receptor species could come into contact with contaminated soils and sediments. However, non-ecologically sensitive areas, such as the former plant area, could contribute to the future degradation of ecologically sensitive areas if they are not remediated to a protective level. By removing lead-contaminated soils and sediments above 500 ppm throughout the site, the likelihood of higher concentrations accumulating in ecologically sensitive areas will be greatly reduced.

   All contaminated areas of the site, except the plant area of the site, require remediation to a level of 500 ppm of lead due to ecological concerns. The plant area is approximately 244,800 square feet. An excavation to a depth of approximately three inches would be required to meet a cleanup goal of 1,000 ppm of lead in the plant area. An excavation to a depth of approximately six inches would be required to meet a cleanup goal of 500 ppm of lead. The difference between excavating three inches to meet a 1,000 ppm cleanup level and six inches to meet a 500 ppm cleanup level is approximately 2,266 cubic yards. This difference represents less than six percent of the total volume of soil and sediments to be excavated under EPA's remedy. Since the plant area would require excavation in any event, the only additional cost of excavating this area to 500 ppm of lead versus 1,000 ppm would be the cost to treat and dispose of the additional 2,266 cubic yards of excavated soil. Conservatively assuming $150 to treat and dispose of this material per cubic yard via solidification/stabilization, the total additional cost would be $340,000. This represents less than six percent of the remedial soil and sediment treatment and disposal costs. In addition to protecting the ecologically sensitive areas of the site, the 500 ppm cleanup level will allow for unrestricted future use of all areas of the site, and will be protective of both human health and the environment.

2. **COMMENT:** The weight of evidence as presented in EPA's Ecological Risk Assessment for the NL site does not support a 500 ppm cleanup level for lead in soils and sediments.

   EPA RESPONSE: During the performance of the Ecological Risk Assessment, EPA carefully considered many factors in developing conclusions. These factors included: the detrimental effects of the contaminants in the soils and sediments to biota; the uncertainties associated with the evaluation of ecological risk; and the impacts to the environment which could be anticipated to occur as a result of the remediation. The Ecological Risk Assessment Report is available in the information repository established for the site. The report clearly supports all of EPA's conclusions.

B. HUMAN HEALTH RISK ASSESSMENT

1. **COMMENT:** EPA's model of childhood lead exposure should not be applied to an industrial site to establish cleanup levels.

   EPA RESPONSE: EPA's model of childhood lead exposure was not used to develop cleanup levels for this site. Rather, a site-specific Ecological Risk Assessment was performed to aid in the development of a cleanup level which is protective of biota at the site.

2. **COMMENT:** The Human Health Risk Assessment shows that no potential adverse health effects are posed by lead at the site. Furthermore, the Risk Assessment evaluated the future use of the site as industrial, and concluded that there would not be any potential adverse health effects from exposure to lead in soils for a worker population.

EPA RESPONSE: The EPA-approved Human Health Risk Assessment performed at the site clearly indicates that lead levels detected in soil, sediment and ground water pose an unacceptable risk to human health. In a baseline human health risk assessment, a cancer potency factor and a reference dose are numerical factors used to quantify risks posed by particular contaminants. However, in the case of lead, there is no EPA accepted cancer potency factor or reference dose established. Therefore, the risk or potential adverse health effects to humans from exposure to lead can not be quantified. A qualitative evaluation of health impacts posed by lead in soils, sediment and ground water indicates that the concentrations of lead detected in these media are above levels of concern to human receptors. Exposure to lead has been associated with human noncarcinogenic effects. The major adverse effects in humans caused by lead include alterations in red blood cell production and the nervous system. High concentrations in the blood can cause severe irreversible brain damage and possible death. EPA has also classified lead as a "B2" carcinogen, which indicates that it is considered a probable human carcinogen.

With regard to all exposure scenarios considered in the baseline risk assessment, where there was a quantified non-acceptable cancer or non-cancer risk, it is plausible that the cumulative cancer risk and hazard indices would be even higher if lead were included.

EPA agrees that the future use of the site is likely to be industrial. However, the Risk Assessment did not conclude that there would not be any potential adverse health effects from exposure to lead by a future worker population. As explained above, the potential risks due to the exposure of a worker populations (or any other human receptors) to lead can not be quantified. EPA has determined, on a qualitative basis, that lead levels detected in soils at the site are unacceptable to human receptors.

C. ECOLOGICAL RISK ASSESSMENT AND STUDY

1. **COMMENT:** EPA's failure to define the goals of its Ecological Risk Assessment, which links the data measured to the risk management process, calls into serious question the overall relevance of its risk assessment and the validity of its final conclusions.

   EPA RESPONSE: The objective of EPA's Ecological Risk Assessment was to collect empirical data on target receptors and surrogate organisms and to use these data to assess the ecological risk of lead contamination at the NL site. The data collected were used to evaluate ecologically based cleanup goals for soils and sediments at the site. The following specific areas of concern were addressed in the study: bioaccumulation of lead by aquatic and terrestrial fauna exposed to contaminated sediment and soil; laboratory toxicity evaluation of sediment; and existing habitat evaluation.

The objective of the ecological assessment, the study design, and the method of data interpretation and evaluation are clearly defined within the Ecological Assessment Workplan and the Final Field Ecological Assessment Report (June 1993). The workplan and final report are available for review in the information repository established for the site.

2. **COMMENT:** The analysis of the data collected during the Ecological Risk Assessment suggests that the distribution of lead at the site is heterogenous, not homogeneous. The study failed to acknowledge that potentially significant portions of the 200-acre study area have lead concentrations below the discrete values used in the Ecological Risk Assessment (1,000 ppm, 2,000 ppm, etc.). This resulted in biased overestimates of wildlife exposure.

   EPA RESPONSE: EPA agrees that the distribution of lead in site soils and sediments is heterogenous. The intent of the study was to evaluate the potential for risk in order to make an informed risk based management decision in selecting a cleanup level. The study's design required the use of soils at discreet contaminant concentrations, which EPA assumed to be present throughout the entire 200-acre study area, in order to evaluate the related effects upon ecological receptors. This methodology provided EPA with a conservative estimate of risk posed to wildlife by evaluating exposure at each soil concentration evaluated.

3. **COMMENT:** The Ecological Risk Assessment does not establish a strong or consistent correlation between lead levels in soils and in earthworms and white-footed mice. The field investigation failed to demonstrate that concentrations in earthworms decreased with decreasing exposure to lead. The inadequacy of the field investigation, the foundation of the Ecological Assessment, largely invalidates its use as support for the lead cleanup criterion of 500 ppm selected in the Proposed Plan.

   EPA RESPONSE: Several factors adequately account for the low correlation between soil lead levels and the accumulation of lead by earthworms observed during the Ecological Risk Assessment. First, it is known that many soil characteristics alter the bioavailability of lead in soil. These include, but are not limited to pH, organic carbon content, particle size distribution, type of soil organic matter, cation exchange capacity, specific soil mineralogy and the chemical form of lead present.

   There are several lead forms which were observed or deemed likely to be present at the site including elemental lead from batteries, lead from within the battery casing material, lead released through air emissions during facility operation, and solubilized lead from spilled solutions. The first two forms were observed directly and have a limited but undefined distribution. The second two may or may not have changed chemical forms since deposition. The first two forms must be weathered to become bioavailable. All of these factors were considered in the evaluation of lead availability, and ultimately the risk posed. These factors may explain the high degree of fluctuation between soil lead levels detected and lead accumulation in earthworms. However, a high correlation between soil lead levels and lead accumulation by earthworms is not necessary to appropriately evaluate the availability and threat posed by the soil lead levels.

A sub-study of the earthworm accumulation study evaluated the relationship between the time the earthworms were stationed in the contaminated soil and the concentration of lead in the earthworms. This study was conducted in order to assess whether or not the accumulation study was of sufficient duration to assume steady state tissue concentrations at the end of the 20-day exposure. The data generated clearly show an accumulation of lead with time. It also showed that as soil lead levels increase, the degree of accumulation of incremental amounts of lead decreases. This observation is consistent with the findings of other studies found in the literature on lead accumulation. It is therefore evident that there is a relationship between soil lead levels and the lead levels found within the earthworms exposed to the contaminated soils. However, not surprisingly, this relationship is not a simple linear relationship and has many confounding factors. It was not the intent of the study conducted to explore the myriad of factors influencing the bioavailability of soil lead levels at the NL site. The study's objective was simply to collect sufficient information to conduct a reasonable and objective Ecological Risk Assessment.

Although a simple relationship does not exist between lead soil levels and earthworm tissue levels, it is clear that the earthworms accumulated lead from the soil. Furthermore, this supports the finding that there is a potential risk to species such as the woodcock (which feed on the earthworms). The data generated suggest that at levels greater than 500 ppm of lead in soil at the NL site, there is the potential for adverse effects. In fact, potential risks exist at even lower concentrations. The risk management decision, therefore, was not based upon the most conservative evaluation of the model. The uncertainties associated with the model assumptions, along with other considerations, support the selection of 500 ppm of lead as the remedial action objective for soils and sediments. However, it is acknowledged that there may be some undefined magnitude of risk posed to receptors similar to the woodcock at levels below the remedial action objective.

With respect to the lead accumulation by mice, the study design only incorporated three exposure levels. Therefore, the lack of a "strong correlation" between tissue levels and soil levels is again not surprising. However, an evaluation of data trends shows that at the highest soil concentrations, there was the greatest bioaccumulation of lead in mice. As with the earthworm study, this demonstrates that there is a relationship between soil lead levels and bioaccumulation of lead at the site.

4. **COMMENT:** The hazard quotient approach used by EPA inappropriately characterizes a population's or community's risks.

   EPA RESPONSE: In a human health risk assessment, the hazard quotient is confined to an individual's risk. However, in an Ecological Risk Assessment, the hazard quotient may be used to evaluate the risk to individuals, populations or communities of organisms. In the Ecological Risk Assessment performed for the NL site, the risk posed to a species was characterized. The species was chosen to be representative of the species and communities of ecological receptors that exist around the NL site. For instance, mink was used to represent carnivores, owls represented raptors, mice represented herbivores, and the red fox represented an omnivore.

5. **COMMENT:** The Ecological Risk Assessment states that the hazard quotient should be interpreted based on the severity of the effect reported and the magnitude of the calculated quotient. Therefore, the effects on the woodcock, which have the highest hazard quotient estimates, would be further reduced because the toxicity endpoints of reduced ALAD (an enzyme which is crucial to the production of hemoglobin) activity, hemoglobin, hematocrit, and brain weight of nestlings are not considered to be as severe as the toxicity endpoints of survival, reproduction or growth.

   EPA RESPONSE: The Ecological Risk Assessment used reduction in ALAD activity, hemoglobin and hematocrit and brain weight of nestlings as toxicity endpoints. Of these toxicity endpoints, reduced brain weight of nestlings was the key indicator of detrimental reproductive success because reduced brain weight may cause reduced learning ability. For example, a nestling could have difficulty learning to fly, recognizing predators, or even recognizing food. All of these factors severely impair reproductive success, growth and survival of the nestling. This implies that the toxicity endpoints of reductions in ALAD activity, hemoglobin, hematocrit, and in brain weight of nestlings are indicative of, and as severe as, the toxicity endpoints of survival, reproduction or growth.

6. **COMMENT:** Midge toxicity test data do not support EPA's claim that there is a lead dose-response correlation.

   EPA RESPONSE: EPA did not conclude from the midge toxicity testing that there was a simple lead dose-response correlation. The objective of the testing was to define the concentration at which toxicity effects from lead on the midge (an insect) would be observed. As part of the study, EPA determined the level of lead in sediment samples which would cause no response to the exposed midge (*Chironomus tentans*). The midge were exposed to varying levels of lead in sediment samples. Midge toxicity was observed when the organisms were exposed to approximately 1,000 ppm of lead. Therefore, 1,000 ppm of lead is considered the best estimate of the LOAEL (Lowest Observable Adverse Effect Level). The LOAEL is the lowest value at which a toxicity response was observed in the test organism.

7. **COMMENT:** EPA's hypothesis that survival of the test organism (the midge) is related to increased bioavailability of lead caused by pH depression is speculative and is not supported by the available data.

EPA RESPONSE: EPA did not conclude that survival of the test organism was related to increased bioavailability of lead that was caused by pH depression. The Ecological Risk Assessment included statements acknowledging the uncertainties associated with the study results and factors which must be considered in evaluating the ecological risks at the site.

Several of these factors related to the bioavailability of lead, and the relation of pH to the test organisms' survival. Lead is generally more bioavailable at lower pHs. Based upon the literature, the test organisms can not survive under extremely acidic conditions (depressed pH). The organisms' pH tolerance range was discussed in the Ecological Risk Assessment. In addition, the study data showed that the test organisms had the greatest response (mortality) at the lowest concentrations of lead, which also had the lowest pH. The data also showed that at higher pHs, there was little mortality at concentrations at or above 1,000 ppm of lead in the sediment.

8. **COMMENT:** Page 10 of the Ecological Risk Assessment states that invertebrates comprise 43 percent of the diet of robins, with 57 percent of the diet comprised of fruits and vegetation. Table 3 in Appendix B provides an exposure calculation based upon worms being 100 percent of the diet. This inconsistency results in a hazard quotient that is roughly twice what it should be.

EPA RESPONSE: With respect to the robin exposure calculations, the Ecological Risk Assessment did not study lead accumulation for alternate diets for robins (including fruits and vegetation). Therefore, the conservative assumption that earthworms would be representative of the total diet for robins, was used in the risk model. This assumption was stated in the exposure pathways for the model, and was appropriately and consistently applied to the exposure calculation.

9. **COMMENT:** The X-Ray Fluorescence (XRF) data used to determine the soil lead concentrations in the areas selected for assessing biological exposure to contamination are of questionable value in a quantitative assessment of exposures. XRF soil analysis significantly overestimates the lead concentrations, which, in turn, results in an overestimation of the exposure estimates for indicator species.

EPA RESPONSE: The XRF was used as a field screening tool, and the field data analyzed by the XRF was confirmed in the laboratory through Atomic Absorption (AA). The confirmatory analyses conducted demonstrate a clear relationship and good correlation between the XRF results and the confirmatory AA results. Therefore, EPA believes that the XRF data collected at the site provides a good representation of site soil concentrations.

10. **COMMENT:** EPA evaluated earthworm lead levels based on exposure of the earthworms to soil lead concentrations in three ranges: less than 500 ppm; 500-1,000 ppm; and greater than 1,000 ppm. The use of these three ranges is arbitrary, and the pattern of the earthworm lead levels is dependent on these ranges. Further, uneven numbers of earthworms were observed from each grouping. An alternate distribution of earthworm observations would suggest that no correlation exists between lead levels in the soil and corresponding levels in earthworms.

    EPA RESPONSE: The groupings of lead concentration ranges were based upon the need for evaluation of potential cleanup goals and are not arbitrary. Since evaluation of the potential for ecological risk is an objective of the study conducted, it is not critical to the evaluation that a clear statistical relationship between total soil lead levels and earthworm accumulation exist. While it is desirable from a mathematical standpoint to have balanced groupings for statistical analyses, this is not critical to the interpretation of the data and the risk assessment. The study determined that the earthworms accumulated appreciable levels of lead from the soil which resulted in an ecological threat.

11. **COMMENT:** There are no statistically significant differences among the mean lead concentrations in mice (dry weight) collected from areas of different lead concentrations (different grid designations).

    EPA RESPONSE: There are differences between the accumulation of lead by white-footed mice in the grid areas. The lack of "statistical significance" in lead accumulation in dry weight normalized tissue data was noted in the text of the Ecological Risk Assessment. It was also stated that statistical significance was found when the wet weight normalized data was evaluated. However, as with the earthworm results, the important point is that the mice within the contaminated areas accumulated lead, and this accumulation was usable for the food chain threat model.

12. **COMMENT:** EPA has failed to consider that risks are derived from exposures of biota to mean soil levels within their home range. The remediation of areas which currently contain the highest soil lead levels would significantly reduce the mean soil levels in the home range of the target species. Exposure should be recalculated taking into account a potential post-remedial reduction in the mean soil levels within a species' home range. This would decrease the calculated mean exposure and risk significantly.

    EPA RESPONSE: As part of the Ecological Risk Assessment, EPA selected various areas of the site to evaluate impacts on receptor species at specific lead concentrations. EPA considered the mean soil concentrations of lead within these specific areas in order to evaluate risks posed to the receptors within these areas. The areas selected were not based on the home range of the target species. The mean concentration for each specific area evaluated was used to represent the entire home range of the target species. This is due to the fact that organisms typically do not utilize their home range evenly. There are preferred areas for nesting, resting and feeding. Many species utilize only a small portion of their home range. Since it is not practical, or in many instances possible, to directly evaluate wildlife utilization of a site, this method assured a reasonable conservative evaluation of risks posed to the target species.

The commentor suggests that EPA recalculate the ecological risks posed by lead contamination at the site taking into account a potential post-remedial reduction in the mean soil levels within a species' home range. This approach is inappropriate as the purpose of the risk assessment was to evaluate the current risks at the site. This evaluation is used by EPA to determine whether to take a cleanup action at the site and the type of action which may be required. The Ecological Risk Assessment performed at the site clearly demonstrated that unacceptable risks are posed to biota by lead-contaminated soils and sediments. EPA's selected remedy for the site will address these risks. All risks posed by the site will be reduced to an acceptable level after remediation.

13. **COMMENT:** The use of scientifically justifiable alternative values for some of the exposure parameters (e.g., home range) and toxicity thresholds would reduce the hazard quotient estimates developed in the Ecological Assessment. The Ecological Assessment proportionately overestimates risks for the woodcock, and a cleanup level derived from consideration of risks to the woodcock would be proportionately too low.

EPA RESPONSE: The Ecological Risk Assessment utilized what EPA considers to be the most reasonable and justifiable values for exposure parameters and toxicity thresholds. EPA believes that these values provide EPA a reasonable and appropriately conservative predicted risk from which to make a risk management decision.

It is obvious that utilizing alternate exposure parameters and toxicity thresholds would alter the hazard quotient estimates developed in the Ecological Risk Assessment. The altered hazard quotient would, in turn, alter the predicted risk to the target species, and thus the cleanup level.

The objective of the Ecological Risk Assessment was not to conclusively determine the risk to the individual target species, such as the woodcock. Rather, the Ecological Risk Assessment provided risk-related information on a representative target species, from which ecologically based risk management decisions can be made.

14. **COMMENT:** The area use factor is incorrectly applied in the Ecological Risk Assessment. The area use factor relates how much a particular area is utilized by a target species relative to another particular area within a target species' home range.

EPA RESPONSE: In order to generate a very specific data set for the area use factor and lead levels existing within the study area, an extremely extensive and costly study would be needed. Fortunately, this was not necessary to evaluate the scenarios considered in this study. Area use factors were appropriately applied in the performance of the Ecological Risk Assessment.

This study evaluated exposure of target species to soil lead levels of 1,000 milligrams/kilograms (mg/kg) and 2,300 mg/kg, even though the average concentration of lead over the 200-acre study area is likely to be less. EPA assumed that any use of the area by the target species, other than that considered in the exposure scenario, would result in increased exposure of the target species.

In the case of the NL Ecological Risk Assessment, EPA selected area use factors that resulted in a conservative assessment of risk. However, EPA does not agree that this approach significantly overstates the risks posed to the target species.

15. **COMMENT:** Available data suggest that a hazard quotient of 8.25 mg/kg/day and a home range of 108 acres for the woodcock should have been used in the Ecological Risk Assessment.

EPA RESPONSE: EPA agrees that the home range for woodcock is 108 acres. Unfortunately, EPA neglected to incorporate the correct home range of 108 acres into the final Ecological Risk Assessment. However, since the area use factor is equal to one, the numerical value of the home range for the woodcock has little effect upon the calculation of the hazard quotient. Therefore, the correct hazard quotient of 8.25 mg/kg/day was used, and the use of the incorrect home range did not impact the risk calculations or conclusions.

16. **COMMENT:** Available data suggest that a lead toxicity threshold of 2.5 mg/kg/day is appropriate for the red fox.

EPA RESPONSE: EPA did utilize the 2.5 mg/kg/day lead toxicity threshold in the risk model in the final Ecological Risk Assessment.

17. **COMMENT:** In its Ecological Risk Assessment, EPA uses a home range size of 57.5 hectare (ha) for the red fox, which is the smallest home range reported in the literature. It is recommended that the average red fox home range should be 698 ha, as this estimate was used by EPA for an Ecological

Risk Assessment performed for the Burnt Fly Bog Superfund site. This figure (698 ha) was deemed by EPA to be the average of available home range values from the literature.

EPA RESPONSE: EPA's estimate of home range value is justifiable for use at the NL site since utilization of areas for foraging by the red fox are uneven. The site also has several different types of landscape including fields, streams, woodlands and wetlands, which may have varying degrees of utilization. The use of conservative home range values accounts, to a degree, for the potential for preferential use of the more highly contaminated areas for foraging by the receptor species.

18. **COMMENT:** There is strong reason to question the validity of EPA's toxicity threshold of 2 mg/kg/day for mink. The value which EPA used was based upon field study data for otters (Mason and MacDonald, 1986). The 1986 study showed no clear correlation between leàd intake (as measured by lead in feces) and adverse population effects could be established.

EPA RESPONSE: There is some uncertainty associated with any toxicological data available for the development of ecological risk models. There are instances where limited options are available for obtaining model parameters. Parameters for otters from the Mason and MacDonald study were applied in EPA's mink exposure model, as parameters for mink were not available. EPA believes that the otter is an appropriate surrogate species for mink as applied in the Ecological Risk Assessment.

Although a simple mathematical correlation was not clearly demonstrated in the Mason and MacDonald study, the study indicated that where there was lead in the feces above an established threshold value, there could be an adverse effect to the target species.

19. **COMMENT:** In the exposure assessment for mink at the NL site, EPA assumed that 50 percent of the mink's diet consisted of the white-footed mouse, which is an upland mammal. If the consumption of upland mammals is to be considered for the mink, it is improper to limit the home range of the mink to the length of an aquatic habitat (non-upland areas) at the site. It is suggested that EPA should have used the average mink home range expressed in terms of area, and not length of aquatic habitat. Available data suggests that 476 acres is an appropriate home range value for mink at the NL site.

EPA RESPONSE: In performing the Ecological Risk Assessment, EPA assumed that the mink's home range is adjacent to the site's aquatic habitat (the streams). This assumption is appropriate for use in evaluating ecological risks.

As discussed in the previous comment regarding the home range of the woodcock, since the area use factor for mink is equal to one, the home range has little effect upon the hazard quotient or the calculated risk. EPA selected model parameters, such as home range, which yield conservative evaluations of the risk such that the potential risk will not be underestimated. This approach can be clearly seen in the mink risk evaluation.

The models presented in the Ecological Risk Assessment are meant to be representative of important food chains and exposure pathways in the environment at the site. The collection of field data and its use in the model is intended to represent the potential exposure which may occur at the site given certain assumptions. Minks are carnivores. Since EPA collected site-specific lead concentration data for both frogs and white-footed mice, it was assumed that each contributed 50 percent to the mink's diet. The frog represented the aquatic forage base, while the white-footed mouse represented the non-aquatic forage base of the mink in the model.

20. **COMMENT:** The dry weight of soils analyzed in the Ecological Risk Assessment was measured by drying at 105° Celsius (C) after screening through a 1.0 millimeter (mm) sieve. The American Society of Testing Materials (ASTM) protocol specifies that drying should be performed at 60° C and a 0.5 mm sieve should be used for screening.

    EPA RESPONSE: EPA believes that the drying temperature and sieve size used for soil analysis are valid values. Since the specific ASTM protocols for measuring dry weight sieve size are not specified by the commentor, EPA is unable to respond to the comment directly.

21. **COMMENT:** The relevance of using cadmium chloride as a reference toxicant in the Ecological Risk Assessment is not apparent.

    EPA RESPONSE: Cadmium chloride was used as a reference toxicant to provide a reference for evaluating the sensitivity of the stock population of test organisms (i.e. earthworms).

22. **COMMENT:** There is no evidence that the reference sediment analyzed during the Ecological Risk Assessment was matched to the sample sediment from the site with regard to Total Organic Carbon (TOC), particle size, and pH.

    EPA RESPONSE: The primary factor in the selection of the reference sediment location was concentration of lead at this location. EPA desired to obtain reference sediment from an upstream (less impacted) area, which was as similar as possible in TOC, particle size and pH to contaminated on-site sediment. The most appropriate reference area was selected based upon the information available at the time of the study.

23. **COMMENT:** Sediment samples obtained during the Ecological Risk Assessment were not analyzed with regard to the presence of any chemical contaminants with the exception of lead.

EPA RESPONSE: Extensive sampling of soil, sediment, ground water and surface water was conducted during the Remedial Investigation performed at the site. A number of samples collected from all media were analyzed for full Target Compound List and Target Analyte List compounds. Based upon the data collected during the RI, EPA determined that the presence of lead in soils provides a good indication of the presence of other contaminants of concern, including cadmium and zinc. The Ecological Risk Assessment determined the risk to ecological receptors posed by lead. Other contaminants of concern would pose additional risk. EPA believes that since lead is the most abundant contaminant of concern at the site, efforts aimed at remediating lead contamination would also address the other contaminants of concern at the site.

24. **COMMENT:** EPA did not confirm laboratory toxicity to benthic (sediment dwelling) organisms by field testing in the streams.

EPA RESPONSE: Field benthic community evaluations were considered in the study design and rejected because of the soft bottom and intermittent behavior of the site streams. These characteristics are not conducive to field testing of benthic communities. Laboratory toxicity testing was considered adequate for the purposes of the Ecological Risk Assessment.

25. **COMMENT:** There are many stages of the Ecological Risk Assessment during which EPA failed to follow ASTM procedures.

EPA RESPONSE: ASTM is not the sole source of standardized or scientifically defensible procedures for the performance of such studies. Since the comment does not further elaborate on deviations from ASTM procedures, EPA can not further respond to this comment. However, it should be noted that scientifically sound and standard methods were used during the Ecological Risk Assessment.

26. **COMMENT:** There were several specific errors in the Ecological Risk Assessment, which include: the incorrect calculation of the hazard quotient for the red fox's daily intake at Areas I/IA and III of the site; the incorrect listing of the hazard quotient for Area I/IA as 10.06 in Table 8, where the actual hazard quotient is 6.06; and, the incorrect listing of the hazard quotient for Area III as 14.13 where the actual hazard quotient is 8.66.

EPA RESPONSE: These errors were corrected and have been incorporated into the risk calculations in the Final Ecological Risk Assessment.

D. SEDIMENT REMEDIATION

1. **COMMENT:** The water quality of the stream segments north of Route 130 should dramatically improve as a direct result of removal of the contributing sources of the contamination. This removal includes the recently completed cleanup of the plant area (including slag, lead-bearing debris, contaminated buildings and contaminated standing water), and the future cleanup of upstream contaminated site soils and stream sediments during implementation of the Record of Decision (ROD) for Operable Unit One as well as EPA's Phase V Removal Action.

   EPA RESPONSE: Removal of upstream sources may reduce the potential for further degradation of surface water quality. However, without removing contaminants above ecologically-based cleanup levels throughout the stream, improved surface water quality could not be ensured since contaminated stream sediments may become resuspended and cause surface water degradation.

2. **COMMENT:** The proposed excavation and dredging of sediments north of Route 130 will be severely detrimental to the aquatic environment in the stream. Such dredging is likely to result in downstream transport of lead-bearing sediments and redistribution of contamination. Dredging these stream sediments would be destructive to the existing ecosystem, increasing turbidity and decimating the benthic flora and fauna. In addition, the ongoing flow and deposition of new sediments from upstream to downstream, from south to north, a process that is continual in the stream, will create a natural cap on top of the sediments north of Route 130.

   EPA RESPONSE: EPA believes that removal of contaminated sediments above 500 ppm of lead from the stream north of Rt. 130 can be accomplished without releasing significant amounts of lead during the operation. A number of engineering techniques are available and will be evaluated during the Remedial Design stage to accomplish this task. These include temporarily damming sections of the stream at both ends, with influent water being pumped around these sections while the sections are being excavated. Silt screens could be used as well to control any accidental release of contaminants during dredging. A hydraulic vacuum could be utilized to remove the contaminated bottom layer of the stream without significantly suspending contaminants. Collected sediments may be dewatered, and then treated along with contaminated soils.

   The ecosystem of the stream north of Route 130 has been detrimentally impacted by site-related contamination and EPA has determined that the ecological benefits of remediation outweigh any temporary impacts. Contaminants remaining in the stream bed, even if covered by a sediment cap, could become exposed due to varying water flow or enter the food chain via bottom dwelling organisms. The reintroduction of lead into the aquatic environment, and the entry of lead contamination into the food chain, would have a deleterious effect upon the downstream ecosystem.

E. SOIL REMEDIATION

1. **COMMENT:** Soil washing has been tested under a number of conditions, at a number of lead-contaminated sites, and has not worked. The key to the success of this technology is the makeup of the soils and sediments. Particle size distribution, organic content and soil texture appear to be key parameters. In the present case, soil compositions are diverse and inappropriate for soil washing technologies which have been tested and suggested to date. It is unlikely that a soil washing technique can be found which will work under these site conditions or achieve the remedial action objectives.

   EPA RESPONSE: In the FS and the Proposed Plan, EPA examined a number of options for addressing the contaminated soils and sediments. Many of the options included either solidification/stabilization or soil washing as a treatment element.

   Soil washing is a promising innovative technology which has been successfully applied to soil remediation at a number of Superfund sites. In the Proposed Plan for the NL site, EPA stated that a treatability study would be required to determine the operating parameters for washing of the contaminated site soils and sediments. The uncertainties associated with the soil washing technology would be quantified during this study to determine if the treatment would be successful in rendering the soils and sediments non-hazardous and in achieving the remedial action objective for soil and sediment of 500 ppm of lead.

   Although soil washing has not been widely used on lead-contaminated soils and sediments, there have recently been favorable applications of soil washing involving such soils. The most recent application has been at the Twin Cities Army Ammunition Plant in Minnesota. This process used a combination of physical separation techniques with an acid extraction step to remove lead from contaminated soils and sediments. At the NL site, a bench-scale study was conducted by the Center for Hazardous Materials Research, which applied the soil washing technology to site soils and sediments. This application was successful in reducing lead contaminant levels from approximately 30,000 ppm to 1,000 ppm. This study was limited in scope, but indicated that the technology may be successful at the site.

   It is possible that a process which combined physical separation and acid extraction could be applied successfully at the NL site. Physical separation would remove the oversize particles (greater than 0.25 inches) from the soil media. The acid-leaching portion of the treatment would chemically remove lead molecules from the soil and sediment particles by solubilizing the lead in an acidic solution.

Based upon comparable applications of the soil washing technology, EPA believes it is likely that soil washing would render the soils and sediments non-hazardous, and may meet the remedial action objective of 500 ppm for lead in soils and sediments. While EPA agrees that soil textures and particle size distribution are key factors in determining the feasibility of soil washing at any site, there are no available data to suggest that the soils and sediments at the NL site would not be amenable to soil washing.

The above notwithstanding, EPA has modified this portion of the remedy. As discussed below, EPA has selected solidification/stabilization technology for the treatment of contaminated soils and sediments.

2. **COMMENT:** S/S is a proven, cost-effective treatment for the soils and sediments at the NL site, and can be more easily implemented than soil washing.

EPA RESPONSE: EPA selected soil washing as the preferred alternative presented in the July 1993 Proposed Plan. However, based upon comments received during the public comment period, EPA has reevaluated all alternatives considered in the Proposed Plan for contaminated site soils and sediments. Many of these comments dealt with the implementability and cost of the proposed remedy. Based upon EPA's reevaluation of the proposed remedy and consideration of the comments received, EPA is selecting the S/S technology, instead of soil washing technology, for the treatment of contaminated soils and sediments.

Soil washing provides the benefit of permanently removing contaminants from the soil matrix. Preliminary studies indicate that this technology may be successfully applied at the NL site. However, EPA recognizes that in order to implement a soil washing remedy, an extensive treatability study would be required. Comprehensive sampling would be required to further define the characteristics and distribution of contaminated soils and sediments. This effort may be time consuming and costly. In addition, if the treatability study indicated that soil washing would not be successful at the site, EPA would need to select an alternative treatment technology.

S/S is a process which physically and chemically binds contaminants into an immobile matrix. Although S/S may increase the volume of treated soils and sediments, and thus may increase the size of the on-site landfill to be constructed, EPA agrees that S/S is a proven treatment process for rendering contaminated soils and sediments non-hazardous, and further, is more easily implemented than soil washing. In fact, the S/S technology was used as part of an earlier remedial action at this site to treat lead-contaminated slag. EPA anticipates that solidifying/stabilizing the soils and sediments could be completed at least one year sooner than soil washing, while providing protectiveness of human health and the environment and greater short-term effectiveness than soil washing. Costs presented in the Proposed Plan also indicate that S/S will be less expensive to implement than soil washing.

Therefore, EPA has selected S/S as the remedy for contaminated soils and sediments. EPA believes it would be readily implementable, has a high probability of success, and is a cost-effective method of achieving the remedial action objectives.

3. **COMMENT:** The Town of Pedricktown supports the proposed treatment for the contaminated ground water, stream sediments and surface water. The town does not object to the proposed treatment process for soils and sediments. However, the Town disagrees with treating only those soils and sediments classified as hazardous waste and would like EPA to treat all the contaminated soils and sediments, thus eliminating the proposed on-site landfill.

   EPA RESPONSE: In the Proposed Plan, EPA stated that nine evaluation criteria were used to evaluate each alternative. Protectiveness of human health and the environment is one of the nine evaluation criteria. Alternative-B (treating all soils and sediments above the remedial action objective) and Alternative-F (the selected soils and sediments treatment alternative which treats only the hazardous soils and sediments and landfills nonhazardous soils and sediments above the remedial action objective) are both protective of human health and the environment. The cost is estimated to be 22 million dollars for Alternative-B versus 6.5 million dollars for Alternative-F. Based upon EPA's evaluation of all alternatives against the nine criteria, EPA believes that Alternative-F provides an acceptable level of protection to human health and the environment, is cost effective, and represents the best balance of all alternatives evaluated. It should also be noted that a 6.6 acre landfill already exists on a portion of the property which is north of the railroad tracks. The additional landfill requirement to implement the selected remedy is expected to be less than 2.5 acres. The planned landfill is expected to be placed adjacent to the existing landfill north of the railroad tracks.

F. GROUND WATER REMEDIATION

1. **COMMENT:** The RI demonstrated that the zone of ground-water contamination is limited, has not impacted off-site areas, and generally consists of concentrations of target compounds that marginally exceed ground-water quality standards.

   EPA RESPONSE: EPA disagrees with this comment. The site extends to areas that have been impacted by site-related contamination. The RI data clearly indicates that ground-water contamination underlying the former plant area of the NL property has been consistently measured at levels greater than an order of magnitude higher than health-based drinking water standards. Ground water outside the former plant area generally demonstrates lower concentrations of contaminants, some of which are above ground-water quality standards. Levels detected in residential wells, which are located off site at some distance from the former plant area, currently comply with ground-water quality standards.

2. **COMMENT:** The RI demonstrated that the contaminants of concern are not mobile and that the zone of ground-water contamination is not expanding over time. Some data indicate that contamination may be decreasing.

   EPA RESPONSE: The RI clearly demonstrates that contaminants of concern have migrated from the plant area of the site. Ground-water data demonstrates that lead contamination has migrated beyond the source at the NL plant and is migrating in a northwesterly direction toward the Delaware River. The aquifer underlying the site is conducive to the migration of contaminants. Ground-water contours indicate a ground-water gradient of 0.0038 to 0.011 ft/ft with the predominate flow in northwesterly direction. Previous data collected at the site from a pump test (Geraghty & Miller, 1983) established the hydraulic conductivity of the unconfined aquifer to range from 1.87 to 45.52 ft/day. Geraghty & Miller (1983) calculated a linear flow velocity that ranges from 0.03 to 2.02 ft/day for the unconfined aquifer with an assumed porosity of 0.25, which indicates a fairly mobile aquifer.

3. **COMMENT:** The RI failed to correlate the extent and distribution of ground-water contamination in the shallow aquifer with the distribution of soil contamination at the site.

   EPA RESPONSE: Based on the RI, soil and ground water are both significantly impacted by contamination originating from previous plant operations at the site. The location and distribution of contamination in ground water and soil are not expected to directly correlate with each other because soil contamination is relatively stationary as a result of deposition, and ground-water contamination is generally mobile as a result of contaminant transport through the aquifer. The transport and distribution of contaminants in ground water are a function of several factors such as absorption, desorption, dilution and dispersion. However, a site-wide review of the RI data indicates that the highest ground-water contamination underlying the plant area generally coincides with the most severe soil contamination.

4. **COMMENT:** The RI failed to provide an adequate characterization of either the shallow unconfined aquifer or the actual connection with lower aquifer systems. It failed to explore potential mechanisms to explain the behavior of the target compounds in ground water.

EPA RESPONSE: The RI clearly characterized both the shallow and lower sections of the unconfined aquifer. The RI defined the aquifer characteristics, including its thickness, hydraulic conductivity, porosity, ground-water gradient, direction of flow, and flow velocity. The terms "shallow" and "lower" aquifer are used in the RI to differentiate between the shallow and lower section of the unconfined aquifer. The RI discussed contaminant mobility with regard to the above-mentioned aquifer characteristics, along with the mobility of lead under conditions found in the aquifer. However, EPA believes, and the RI stated, that updated and more detailed aquifer data would be required to design any ground-water remediation system. This information will be obtained during the RD stage.

5. **COMMENTS:** The FS did not include an assessment of the technical feasibility of the recovery of contaminants of concern for the shallow, unconfined aquifer.

RESPONSE: The FS described a conceptual ground-water extraction system, along with a treatment system to remove contaminants of concern from the extracted ground water. The RI/FS indicates that contaminants of concern were detected at levels which greatly exceed Maximum Contaminant Levels (MCLs) and could be recovered through a ground-water recovery system. The FS clearly provided a conceptual scheme for the recovery of contaminants of concern from the shallow, unconfined aquifer. During the Remedial Design (RD) stage of the project, additional work will be performed including: additional data collection; ground-water modeling of contaminant transport; and treatability studies. This information will be used in the detailed engineering design of the ground-water recovery and treatment system.

6. **COMMENTS:** The proposed use of the existing ground-water recovery system is a solution of convenience which fails to address actual conditions and the documented zone of contamination.

EPA RESPONSE: EPA did not propose to use the existing ground-water recovery system. In EPA's Addendum to the FS, it is clearly stated that the existing recovery system will be evaluated for its potential use in the recovery of ground water during the RD. Based on this evaluation, the existing recovery system will either be used, modified, or abandoned. The final recovery system will address ground-water contamination above health-based levels and will be designed during the RD stage.

7. **COMMENT:** The assessment of ground-water remediation strategies did not consider the source(s) of ground-water contamination, or the potential effects of source removal (industrial area sources and soils) on the long-term aquifer quality.

EPA RESPONSE: Contributing contaminant sources from the slag piles and contaminated debris, which were a source of contamination since at least

1984, have been removed and remediated under the Operable Unit Two remedy. Soil which is contaminated above EPA's remedial action objective will be remediated as part of the selected remedy for soil, in conjunction with the selected ground-water remedy. Therefore, all potential continuing sources of contamination to the aquifer will be addressed as part of the remedy for Operable Unit One.

The design of the selected ground-water extraction system will be based on appropriate data, some of which will be collected in the Remedial Design phase of the project. Site conditions since the removal of significant sources of contamination emanating from the plant area will be reflected in the design as appropriate. It will also incorporate the effect of remediating soils contaminated with lead above the remedial action objective. Even after the surface sources of contamination have been eliminated, ground water which is already contaminated will require remediation to meet health-based levels established for the aquifer.

8. **COMMENT:** The proposed extraction rate for the ground-water extraction system is unrealistic and does not consider aquifer capacity.

   RESPONSE: EPA has not proposed a rate of pumping for the ground-water extraction system. The estimated pumping rate of 250 gallons per minute was intended only to be used for the comparison of remedial alternatives and the relative cost associated with each alternative. As stated in EPA's Addendum to the FS, pumping rates, configuration of the ground-water extraction system, and location of extraction wells as described in FS Report were not intended as a final design. The ground-water extraction system will be designed during the RD stage, and will consider aquifer capacity as a design parameter.

9. **COMMENT:** The remedial strategy for ground water is based on the premise that there is a substantial and imminent threat to public health. This premise is contrary to the findings documented in the RI and re-stated in the Proposed Plan.

   EPA RESPONSE: Concentrations detected within the ground water underlying the site exceeded the remedial action objectives for both lead and cadmium by over an order of magnitude. These remedial action objectives are based upon water quality standards established to protect public health.

   The RI showed that lead in ground water in the vicinity of the former plant area ranged from 3,130 parts per billion (ppb) to 4,400 ppb, and cadmium concentrations ranged from 6 ppb to 997 ppb. The remedial action objective for lead in ground water is the New Jersey Ground-Water Standard of 5 ppb with a Practical Quantitation Limit (PQL) of 10 ppb. The PQL is the lowest concentration that can be reliably detected by a laboratory during routine laboratory operating conditions, as established by the NJDEPE, as part of the New Jersey Ground-Water Standards. The remedial action objective for cadmium is the New Jersey Ground-Water Standard of 4 ppb. Other metals detected on the site at elevated levels include arsenic, beryllium, chromium, copper, nickel and zinc. Volatile organic compounds exceeding Federal MCLs were found in two wells, and include 1,1,1 trichloroethane at levels up to 4,700 ppb, 1,1-dichloroethane at 74 ppb, 1,1 dichloroethylene and tetrachloroethene at 210 ppb, and vinyl chloride at 76 ppb.

The Human Health Risk Assessment concluded that there was an unacceptable risk posed by exposure to ground water for future exposures (under current and future land uses) via ingestion, dermal adsorption, and inhalation. It should be noted that the risk posed by lead could not be quantified, however, it is deemed to be present in unacceptable levels based on a qualitative risk evaluation. A quantitative risk assessment was performed for contaminants other than lead which were detected at the site. This risk assessment resulted in the calculation of risk levels which exceeded EPA's acceptable risk range. Since ground-water contamination exceeds established remedial action objectives for the protection of human health, and poses unacceptable risks, it represents a substantial and imminent threat to public health and the environment, necessitating remediation of the aquifer.

10. **COMMENT:** The conceptual ground-water remediation strategy includes restoration of a non-use aquifer to ground-water quality standards (for primary drinking water sources) as a means to protect a public which, as agreed by EPA in the Proposed Plan, is not now being exposed.

EPA RESPONSE: The ground water underlying the site is classified as Class 2A, a potable drinking water source, by the State of New Jersey. Future exposure pathways under current and future land-use scenarios indicate that this ground water would pose unacceptable risks to human health as a result of ingestion, dermal adsorption, and inhalation at current contaminant levels. Because of the aquifer's classification as a potable drinking water source, it will be remediated to established health-based drinking water standards.

11. **COMMENT:** Both Alternative G-2 (discharge of treated ground water to the Delaware River), as well as Alternative G-1 (discharge of treated ground water to the East or West Streams) should be retained, and the selection of the final discharge point should be made during the Remedial Design phase of the project. Alternative G-2 may be more implementable and cost effective than Alternative G-1, and both alternatives are feasible in terms of time, permitting and access.

EPA RESPONSE: EPA believes that adequate information is available at this time to determine the most appropriate ground-water treatment and discharge alternative.

Both Alternative G-2 (discharge of treated ground water to the Delaware River), and Alternative G-1 (discharge of treated ground water to the East or

West Streams) include similar ground-water treatment systems. However, discharge to the on-site streams would likely require a reverse osmosis unit. The reverse osmosis unit would be designed to remove total dissolved solids (TDS) from the treatment plant effluent to meet applicable discharge standards.

As discussed in the Proposed Plan, EPA agrees that Alternatives G-1 and G-2 would be equally protective of human health and the environment. Both alternatives would require similar and available treatment technology and can be constructed on site. However, it is likely that Alternative G-2 would not require a reverse osmosis unit, which would make the system easier to operate. Reverse osmosis units often require a significant amount of maintenance to operate reliably and are expensive to run.

The system for surface discharge associated with Alternative G-1 would be easier to construct and maintain than the discharge system for Alternative G-2, which would require a pipeline to be constructed from the site approximately one and one-half miles to the Delaware River to transport and discharge treated ground water. The pipeline could be constructed using standard construction techniques and would traverse off-site properties between the site and the Delaware River.

In the Proposed Plan, EPA stated that there was uncertainty with respect to procuring the appropriate access agreements prior to construction. The planned discharge pipe would cross underneath rail road tracks (between the plant area and the landfill) and Route 130, which may require additional access agreements and permits from state and local government, as well as private parties. Construction of such a pipeline in marshy areas and wetlands may be difficult to implement.

Written comments submitted to EPA included letters from private property owners whose right-of-way would be required to build the pipeline to the Delaware River under Alternative G-2. EPA has reviewed these letters which indicate that the necessary land-owning parties have no objection to entering into negotiations for the granting of an easement to construct the pipeline. In addition, B.F. Goodrich, a neighboring facility, recently constructed its own discharge pipeline under Route 130 and through the U.S. Army Corp of Engineers Dredge Spoils to the Delaware River.

Therefore, currently available information indicates that discharge of treated ground water to the Delaware River described in the Proposed Plan (Alternative G-2) may be more easily implementable than previously envisioned relative to discharge to the on-site streams (Alternative G-1). Since the treatment plant required for Alternative G-2 would be more reliable and economical to operate than that required for Alternative G-1 (because discharge to the Delaware River is not likely to require a reverse osmosis unit to reduce TDS in the effluent), EPA has chosen Alternative G-2, discharge of treated ground water to the Delaware River, as the selected remedy for ground water.

12. **COMMENT:** The Proposed Plan does not consider the RI's recommendation for additional investigations, nor the FS's recommendation for further evaluation of ground-water reinjection options. The final selection is made despite this lack of information.

EPA RESPONSE: The RI included a comprehensive study to determine the nature and extent of contamination in site soils, sediments, surface water and ground water. The RI Report contains an extensive analysis and discussion of aquifer characteristics, as well as the findings of the ground-water, soil, sediment and surface-water analyses at the NL site. The RI Report contained all relevant data necessary to develop and evaluate ground-water remediation alternatives. During the RD phase, supplemental information will be obtained as necessary to perform the detailed engineering design of the selected ground-water remediation system.

The FS Report contains extensive discussion regarding the many ground-water reinjection options evaluated during the FS. EPA evaluated a total of seven different options for addressing contaminated ground water at the site. Five of these included various means of reinjecting treated ground water into the aquifer underlying the site.

In addition to the two surface-water discharge options evaluated, the Proposed Plan and the FS thoroughly evaluated two alternatives which include the reinjection of treated ground-water into the aquifer. These were Alternative Ground Water-E, reinjection into the unconfined aquifer, and Alternative Ground Water-F, reinjection into the confined aquifer. Sufficient information was available during the writing of the FS and the Proposed Plan to evaluate each alternative and to select a ground-water remedy. Ground-water reinjection options were thoroughly evaluated and took into consideration a number of factors including the aquifer characteristics. Based on EPA's detailed evaluation of all ground-water discharge options, it was determined that the reinjection options were not as implementable as the options which included surface water discharge of the treated ground water. The evaluation of all ground-water discharge options, based on the nine criteria established under CERCLA, is presented in the FS Report and summarized in the Proposed Plan.

G. PHASE V REMOVAL ACTION

1. **COMMENT:** EPA's Phase V removal action, which includes the removal of contaminated sediments from the West Stream, is inconsistent with the National Contingency Plan (NCP).

EPA RESPONSE: EPA's Action Memorandum authorizing a removal action at the NL site in Pedricktown, New Jersey, was issued on July 15, 1993. The NL site meets the criteria for a removal action under the Comprehensive Environmental Response, Compensation and Liability Act, as amended (CERCLA), and as described in Section 300.415 of the NCP.

The following criteria from Section 300.415(b)(2) of the NCP are directly applicable to the threats that exist at the NL site:

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, or pollutants, or contaminants;

(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

(iv) High levels of hazardous substances, or pollutants, or contaminants in soils and sediments largely at or near the surface that may migrate;

(v) Weather conditions that may cause hazardous substances, or pollutants, or contaminants to migrate or be released; and

(vii) The lack of availability of other appropriate federal or state response mechanisms to respond to a release.

In addition, EPA determined that this removal action is a time-critical action, as there is a period of less than six months available before cleanup activities should begin. Due to the time-critical nature of this removal action, EPA initiated the Phase V Removal Action in July 1993.

2. **COMMENT:** The removal action is not consistent with the long-term remedy at the NL site as required by the NCP. In addition, all upgradient sources have not yet been removed, possibly allowing the stream to become recontaminated.

EPA RESPONSE: The on-going removal action is consistent with, and will contribute to, the efficient performance of any anticipated long-term remedial action at the site. All of the contaminated sediments addressed under this removal action would have been addressed during future remedial activities. The removal action provides immediate protection of public health, welfare and the environment. Without taking immediate action, overflow of stream banks could deposit lead-contaminated sediments on adjacent downstream properties. Flooding of the stream could transport contaminated sediments further downstream, affecting the water quality of the Delaware River. During dry periods, highly contaminated dried sediment could become airborne and expose humans and environmental receptors to lead bearing dust.

EPA is concerned about protecting the West Stream from recontamination. Upgradient contaminant sources, such as lead bearing debris and slag piles, have been removed during the Operable Unit Two remedial action. Although contaminated soils remain between the West Stream and the plant area of the site, measures will be taken during the removal action to prevent recontamination of the West Stream from contaminated soils.

3. **COMMENT:** There will be an inherent waste of mobilization costs for the removal action, since remediation of the West Stream could be carried out at the same time as remediation of the East Stream and site soils.

   EPA RESPONSE: This removal action, and the entire cost of this removal action including mobilization costs, are justified based upon the removal action criteria listed in §300.415(b)(2) of the NCP. In addition, EPA has determined that this removal action is time critical, and, as stated in EPA's July 1993 Removal Action Memorandum, a prompt removal activity is necessary to protect public health and the environment.

4. **COMMENT:** More than 12 months have elapsed since removal activities began on site. Thus, the Phase V removal actions contravenes CERCLA and the NCP §300.415(b)(5).

   EPA RESPONSE: The NCP §415(b)(5) provides that, for fund-financed removal actions, more than 12 month may elapse from the initiation of removal activities on site if the lead agency determines that; (i) there is an immediate risk to public health or welfare of the environment; or (ii) continued response action is otherwise appropriate and consistent with the remedial action to be taken. In the case of this removal action, EPA has determined that both conditions have been met.

5. **COMMENT:** EPA was required to conduct an engineering evaluation/cost analysis (EE/CA), which should have been made available for public comment. No EE/CA was ever performed or distributed for public comment.

   EPA RESPONSE: In accordance with Section IV.A.4 of EPA's Action Memorandum, issued on July 15, 1993, the proposed removal action was determined by EPA to be of a time-critical nature; therefore, an EE/CA is not required.

6. **COMMENT:** EPA has known the identity and location of numerous Potentially Responsible Parties (PRPs) prior to the onset of this removal action. EPA did not notify any of the PRPs regarding any phase of the removal action, nor had EPA made any effort to determine whether the PRPs could or would perform the necessary removal action promptly and properly.

   EPA RESPONSE: EPA indicated in Section VII of the Action Memorandum, issued on July 15, 1993, the time-critical nature of this removal action in order to protect the public and the environment. EPA has identified a number of PRPs for the site. However, EPA believes that notification of the PRPs and negotiation of an administrative order to provide for the performance of the Phase V Removal Action by the PRPs would be a lengthy process. This would likely have prevented a timely initiation of the removal action as required by the circumstances at the site pursuant to the NCP.

7. **COMMENT:** The Phase V removal action is a thinly disguised public works project.

   EPA RESPONSE: As stated previously, the Phase V removal action is justified by, and consistent with the NCP based on threats to human health and the environment.

8. **COMMENT:** While EPA will be excavating the first foot of sediment from the stream, EPA is voluntarily donating resources to the Salem County Mosquito Control Commission (SCMCC) stream enhancement program by excavating the stream to 14 feet wide, while it is currently only up to six feet wide. EPA is spending federal (Superfund) funds to remove specific areas based upon local flooding concerns dictated by the SCMCC, rather than any environmental criteria described in §300.415 of the NCP.

   EPA RESPONSE: EPA's coordination with the SCMCC represents efficient planning and coordination between federal and local governments. The removal of contaminated sediment and soil was dictated strictly by environmental concerns, and not by drainage concerns. All material excavated under this removal action is above EPA's established cleanup criteria of 500 ppm of lead in soil and sediment (which is consistent with EPA's cleanup criteria determined in this ROD). Furthermore, the removal action being performed meets all of EPA's removal action criteria and is consistent with the long-term remediation of the site.

APPENDIX V

RESPONSIVENESS SUMMARY
ATTACHMENT A

LETTERS SUBMITTED DURING THE PUBLIC COMMENT PERIOD

George W. Bradford
Township Mayor
Phone: 299-5358

OLDMANS TOWNSHIP

SALEM COUNTY NEW JERSEY
Phone: 299-0780

Township Clerk
ildred A. Hyatt
Phone: 299-2949

P.O. Box P
Pedricktown, N.J. 08067

August 17, 1993

Michael Hilbert, Project Manager
U.S. Environmental Protection Agency
Emergency + Remedial Response Division
26 Federal Plaza, Room 720
New York, New York 10278.

Dear Mick,

For the official written record, I wish to make the following comments on behalf of the Oldmans Township Committee concerning the EPA. Superfund Proposed Plan for N.L. Industries, Inc. Operable Unit One here in Pedricktown, New Jersey:

(1.) We support the proposed treatment for the contaminated groundwater.

(2.) We support the proposed treatment for the contaminated surface water and stream sediments.

(3.) We strongly OBJECT TO and DISAGREE WITH the limitation for contaminated soils proposed treatment.
We have no problem with the treatment process for the contaminated soils; however, treat all the contaminated soils and eliminate the proposed LANDFILL on site altogether !!!!!

NLI0022376

OLDMANS TOWNSHIP
SALEM COUNTY NEW JERSEY

At the public meeting on August 2, 1993, I
clearly started our _distaste_ concerning the
landfill element of the proposed treatment
for contaminated soils. The secured
landfill currently located there on the
site is already _one_ ~~too~~ _many_!!!

I believe that there are many factors
considered before reaching a proposed
treatment plan, but I also firmly believe
that the _cost factor_ determines the end
result in most cases. This _should not_
be the circumstance for Oldmans Township.

Our community and its residents have
suffered long enough. The time has come
for us to put this "Superfund Site" to
rest once and for all.

We sincerely believe that it has been
done right to this point. Stay the course,
and complete the cleanup with what is
not only the _best solution_, but also the
right solution!

Thank you,

George W. Bradford
Mayor, Oldmans Township

SIDLEY & AUSTIN
A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS

ONE FIRST NATIONAL PLAZA
CHICAGO, ILLINOIS 60603
TELEPHONE 312: 853-7000
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WRITER'S DIRECT NUMBER
(312) 853-2659

September 17, 1993

Michael Gilbert, Project Manager
U. S. Environmental Protection Agency
Emergency and Remedial Response Division
26 Federal Plaza, Room 720
New York, New York 10278

Re: <u>N. L. Industries, Inc. Superfund Proposed Plan</u>

Dear Mr. Gilbert:

Pursuant to Section 300.430(f)(3)(C) of the National Contingency Plan, the companies listed below[1] submit these comments to the United States Environmental Protection Agency ("U.S. EPA") on the proposed plan for Operable Unit 1 at the N. L. Industries, Inc. Superfund Site in Pedricktown, New Jersey ("Proposed Plan"). Our comments mainly address two areas of concern:

- The soil clean-up standard and soil-washing technology proposed by the U.S. EPA and our suggested alternatives to the proposed technology.

- Groundwater data and the extraction plan chosen in the Proposed Plan.

The discussion below is intended to summarize the more expansive discussions contained in Attachments A through C.

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[1] The parties to this correspondence are: Allied Signal Inc., AT&T, C&D Charter Power Systems, Inc., Exide Corporation, and Johnson Controls, Inc. Please note that of these companies, Sidley & Austin represents only Johnson Controls in this matter.

1. Soil Clean-up.

As noted, our concerns regarding soil clean-up center on the 500 ppm standard chosen as the soil remediation level and the technology U.S. EPA has chosen to address contaminated soils. Irrespective of what clean-up limit may be appropriate, we offer alternatives to the suggested technology which are both implementable and more cost effective.

a. Critique of Proposed Plan.

Regarding the 500 ppm remedial action objective, the Proposed Plan first establishes that, according to a guidance entitled "Interim Guidance on Establishing Soil Lead Clean-up Levels at Superfund Sites," the recommended soil clean-up range is 500 – 1000 ppm. The Proposed Plan then implies that the principal basis for choosing a 500 ppm standard was the site ecological study. Attachment A evaluates the ecological assessment, noting three important inadequacies: (1) U.S. EPA failed to follow its own guidance regarding defining assessment endpoints (i.e., specific designations of the ecological grouping to be protected) prior to conducting the assessment; (2) the assessment is based on a simplistic model that does not meet U.S. EPA's stated goals; and (3) the assessment is based on data collected in such a manner as to preclude meaningful assessment of site-specific risks. The evaluation concludes that the ecological risk assessment is flawed and does not provide a sound basis for the 500 ppm lead clean-up standard.

Reliance on the interim guidance as a basis for justifying the 500 ppm standard is equally problematic. First, on its face the guidance applies to clean-up in residential areas. However, the site is currently in an industrial area, and given that a hazardous waste landfill will remain on-site, the site is unlikely to be used in the future as a residential area. Consequently, the use of a residential clean-up criteria designed to protect young children is inappropriate. The clean-up standard should instead be specific to the potential health threats to adults who might be present at the site during the work day. Furthermore, we understand that the U.S. EPA intends to revise its guidance for the clean-up of lead at Superfund sites. Recent efforts under the Housing and Community Development Act indicate that even for residential areas the current U.S. EPA-preferred strategy for remediation may be to require excavation of soil containing lead at levels of 2,000 ppm and above, but to allow the undertaking of other activities for clean-up of soils with lead levels under 2,000 ppm. A major reason for this current position is the government-sponsored studies in urban areas over recent years which indicate little correlation between blood lead levels in children and soil lead levels in the surrounding areas. In particular, soil removals in Baltimore and Boston had little or no effect on subsequent blood levels in children, and blood studies in other areas, like Granite City, Illinois and Aspen, Colorado also indicate little correlation.

Finally, reliance on a guidance without both independently supporting the premises set forth in the guidance and taking into account case-specific factors is tantamount to illegal rulemaking. See McLouth Steel Products Corp. v. Thomas, 838 F.2d 1317 (D.C. Cir. 1988). Other than the flawed ecological site assessment, there is no evidence that the U.S. EPA gave serious consideration to any site-specific factors in its selection of a soil clean-up level. In the absence of useful site-specific information, relying on the guidance as if it were a binding rule is illegal since the document has not been subjected to proper rulemaking procedures. For all these reasons, U.S. EPA's decision to set the soil lead action level at 500 ppm is untenable scientifically and is entirely unsubstantiated in the record.

Regarding soil clean-up technology, Attachment B discusses EPA's proposal to use soil washing. In short, soil washing has been tested under a number of conditions, at a number of sites, and has not worked. The key to the success of this technology is the make-up of soil -- particle size distribution and soil texture appear to be key parameters. In the present case, soil textures are diverse and inappropriate for technologies which have been tested and suggested to date, and it is unlikely that a soil-washing technique can be found which will work as necessary under these site conditions or achieve the remedial action objective.

b. Alternative Proposal.

The parties to this correspondence propose the following alternatives, which we believe provides a greater environmental benefit than the remedy in the Proposed Plan at reduced cost. As our first alternative, we propose that soils which exhibit a hazardous characteristic be stabilized and consolidated on-site with other soils exceeding the action level. As our second alternative, we propose that soils which exhibit a hazardous characteristic when tested according to the Toxic Characteristic Leaching Procedure be taken off-site and stabilized before land-filling. Soils which exhibit the same hazardous characteristic, but fall within the exemption to U.S. EPA's land disposal restrictions because they do not fail the Extraction Procedure Toxicity test, would be disposed of off-site in a hazardous waste landfill without treatment. Soils that do not exhibit a hazardous characteristic, under our second proposal, would be consolidated on site or transported for use as daily cover at a local landfill, where the soils would serve a useful function and yet be removed from the site.

In addition to the environmental benefits conferred by total removal from the site, we think it worth emphasizing that the soil-washing technology cannot be implemented without great expense, relative to the other alternatives. As noted in Attachment B, while soil-washing would cost in excess of at least $10 million without any assurance of success, our first alternative would cost about $5.6 million, and our second alternative would cost between $7 million and $8.4 million.

2. Groundwater Remediation Under the Proposed Plan.

a. Critique of Proposed Plan.

The comments set forth in Attachment C regarding groundwater question both the current relevance of the groundwater data and also the interpretation of that data, in the Remedial Investigation, in the choice of alternatives set forth in the feasibility study, and in the Proposed Plan.

The data used to develop the groundwater response action is now four years old. Groundwater measurements were taken at the site over an extended period of time preceding 1989, and throughout the monitoring period there was a general downward trend in contaminated concentration. Given the propensity of metals to adsorb to soil particles, it is likely that the trend has continued and that the groundwater problems raised in four-year old data may be greatly attenuated. The fact that lead is quickly immobilized in soil also leads to questions about the interpretation of the alleged groundwater problem. Commonly, if lead does migrate downward through soil, its continued migration depends on there being an acidic environment. While battery acid may have been present at the site during operation, it has not been present over the last decade. Rather than being viewed as a plume, the presence of lead is probably residual and contained.

Regarding the source of any lead which may have migrated to groundwater at the Pedricktown site, it would likely be traced to former sources of acid on-site, such as the batteries which were received at the facility and lay about it over an extended area during times in which the smelter furnace was not operating; the battery breaker itself, from which acid may have leaked; or perhaps the site acid holding tank which, according to facility records, may have leaked during the facility's operation. Another possibility is the landfill, which may have spiked the groundwater with some lead when its leachate collection system clogged.

Even if actionable levels of lead remain in the groundwater after soil remediation, the use of the current wells to extract groundwater in accordance with the Proposed Plan will result in the extraction of a large amount of clean water because of their placement outside of the area of concern. In turn, that clean water will be mixed with contaminated water, and a large volume of slightly contaminated water will have to be discharged. Rather than rely on an exterior ring of wells to extract the groundwater, if necessary at all, wells should be located in the areas showing the most severe contamination and pumped in a manner which minimizes mixing with clean water.

b. Groundwater Recommendations.

Given the downward trend of the data and the possible sources for lead migration to groundwater, the parties to this correspondence recommend that U.S. EPA draft a Record of Decision that allows sufficient latitude for an appropriate groundwater remedy design to be determined based on information gathered as and after soil remediation occurs. We propose that U.S. EPA proceed with the soil remediation and take groundwater samples during that period. At the end of the soil remediation period, given the results of the sampling and analysis, U.S. EPA should then consider which groundwater design is most appropriate and proceed accordingly. If groundwater is no longer a problem, U.S. EPA should reconsider the no-action alternative.

If recovery wells are shown to be necessary after further sampling, the Record of Decision should also allow sufficient latitude to permit reinjection of treated groundwater, as the groundwater flow rate is likely to be much less than predicted in the Feasibility Study. This option requires allowing latitude for the creation of a Classification Exception Area, as provided for by State regulations, which permits discharge of treated water back to the aquifer at higher concentrations than the standard as long as groundwater is restored to the applicable standard at the completion of the groundwater treatment process. The small amount of lead contained in the groundwater will be immobilized and the perceived problem will cease without contaminating thousands of gallons of clean groundwater unnecessarily or moving trace amounts of lead into a local stream.

We thank you for this opportunity to comment on the Proposed Plan and request that the Record of Decision appropriately address the parties' comments.

Yours very truly,

Dennis P. Reis

Dennis P. Reis

PR:lcd

DPR93A74.SBC (9/17/93 5:00pm)

ATTACHMENT A

COMMENTS ON USEPA'S PROPOSED CLEAN-UP LEVEL FOR LEAD AT THE NL INDUSTRIES, INC. SITE, PEDRICKTOWN, NEW JERSEY

Prepared by:

WEINBERG CONSULTING GROUP Inc.
1220 19th Street, NW
Washington, D.C. 20036

August 30, 1993

COMMENTS ON USEPA'S PROPOSED CLEAN-UP LEVEL FOR LEAD AT THE NL INDUSTRIES, INC. SITE, PEDRICKTOWN, NEW JERSEY

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TABLE OF CONTENTS

COMMENTS ON USEPA'S PROPOSED CLEAN-UP LEVEL FOR LEAD AT THE NL INDUSTRIES, INC. SITE, PEDRICKTOWN, NEW JERSEY

INTRODUCTION

USEPA (1993a) has proposed a remedial objective for lead of 500 ppm in wetland soils and stream sediments of the NL Industries Inc. site in Pedricktown, New Jersey (NL site). This remedial action objective was derived based on USEPA's interpretation of the results of a field ecological assessment and an ecological risk assessment conducted for the site. Specifically, USEPA (1993b) derived this objective based on the results of sediment toxicity tests conducted at the site and then used the results of an ecological risk analysis conducted for potential terrestrial wildlife inhabitants of the site to substantiate this lead level. We believe that the proposed remedial action objective for lead is not supported by the analyses presented by USEPA. In fact, we do not believe that USEPA has yet demonstrated that the site poses any risks to aquatic or terrestrial wildlife populations and that remediation for the protection of wildlife might not be warranted. This document provides support for our position.

REVIEW OF SEDIMENT TOXICITY TESTS

USEPA conducted site-specific toxicity tests on the midge, *Chironomus tentans*, using sediment samples collected from two streams that drain the site to the east and west (East and West streams). Samples were collected from areas of the streams that were identified by the use of field screening analyses as having sediment lead concentrations within specified target levels ranging from less than 100 ppm to greater than 2,000 ppm. Based on the results of the *C. tentans* assays, USEPA concluded that there was demonstrable toxicity associated with site sediments at sediment lead concentrations of 1,100 ppm. To derive the remedial objective of 500 ppm, USEPA applied an arbitrary safety factor of 2 to this number and rounded off to the lowest 100.

We believe that the remedial objective proposed by USEPA is not supported by the results of the sediment toxicity tests. Further, we believe that the toxicity tests relied on by USEPA were seriously flawed and should not be used as the basis for regulatory decision making at the NL site.

Interpretation of the Results

USEPA (1993c, p. 33) notes that "mortality of midge larvae exposed to site sediment was not directly related with (*sic*) sediment Pb concentrations." In fact, based on the data presented in the reports, there is no relationship at all between midge mortality or other test endpoints and sediment lead concentrations. In addition, the data suggest that other factors are the possible cause of the observed responses.

Toxicity test data do not support USEPA's claim that there is a lead dose-response relationship. It is an accepted principle of environmental toxicology that the response of an organism to a toxicant is a function of the dose of the toxicant. Thus, if lead in sediments from the NL site was toxic to *C. tentans*, we would expect a correlation to exist between lead concentrations and toxicity endpoints. Using the data presented in the USEPA (1993c) report, we calculate a coefficient of determination (r^2) for the hypothesized relationship between sediment lead levels and survival of 0.22, clearly indicating that no significant relationship between dose and response exists. Further supporting the lack of a dose-response relationship is the fact that *C. tentans* exposure to the highest sediment lead concentration (4,400 ppm) was associated with precisely the same percent survival as the laboratory control sample.

Similar results are found for *C. tentans* length[1] (an indication of growth). There was no dose-response relationship (mean organism length was greater at 4,400 ppm than at 1,100 ppm), and there was no significant difference in mean length between organisms exposed to 4,400 ppm lead (17.51 ± 0.96) and the controls (18.80 ± 1.03).

There also was no dose-response relationship for growth expressed as either wet-weight or dry-weight. Further, the statistical significance associated with these tests contradicts the basic dose-response relationship that USEPA purports to exist: growth was statistically elevated for organisms exposed to 4,400 ppm lead compared to 1,100 ppm lead. It is difficult to hypothesize a mechanism of lead toxicity that implies a negative relationship between dose and response.

USEPA's hypothesis that survival is related to increased bioavailability of lead caused by pH depression is speculative and is not supported by the available data. USEPA (1993c) notes that there were problems associated with pH and alkalinity control during the assay and hypothesizes that reduced pH resulted in an increased bioavailability of lead from the sediment. The available data, however, do not support USEPA's hypothesis. In fact, the quality and type of data available cannot even be used to advance this speculation.

The pH measurement exhibited an extremely wide range in the various tests. Four of the five samples had pH values outside of those associated with *C. tentans* in the natural environment. By the end of the experiment, all of the samples had pH values significantly different from the control sample. Based on our calculations, there is no correlation (r^2) between final pH and survival. Although alkalinity and pH are chemically related, the problems with alkalinity control were even more striking than with pH control. Alkalinity was never detected in one sample and was found at the detection limit in two others; thus, there is no analytical certainty concerning the alkalinity measured. The alkalinity measurements changed markedly throughout the

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[1]It should be noted that ASTM (1993) recommends using weight rather than length as a measure of *C. tentans* growth.

course of the experiment; in some cases increasing and in others decreasing. This is likely a consequence of the low buffering capacity of the dilution water and the tendency to achieve equilibrium with atmospheric carbon dioxide. Regardless of the hypothesized mechanism, the differences in final alkalinity are sufficient to account for 73% of the variability in survival based on our analysis of the data. We also find parallels between alkalinity and other toxicity endpoints measured in these bioassays.

Given these limitations, the only data that could be used to support USEPA's speculation regarding increased lead bioavailability are measurements of lead in the test water. However, no measurements were made of the amount of lead released into the water, and therefore, the effect of pH can never be known. The failure to match samples and the control with regard to pH, alkalinity, or conductivity further complicates the interpretation. The aqueous chemistry of lead is extremely complex; conclusions cannot be drawn without performing water quality analyses and, as necessary, a speciation model. The fact that no significant correlation existed between pH and survival suggests that USEPA's speculation is inaccurate.

<u>Methodological Problems with the Toxicity Tests</u>

There are numerous concerns about the conduct of the toxicity test and its documentation that further argue against USEPA's assessment of risk. These include the following:

- Dry weight was measured by drying at 105° C after screening through a 1.0-mm screen. ASTM (1993) protocol specifies 60° C and a 0.5-mm screen.

- The relevance of using cadmium chloride as a reference toxicant is not apparent. Not only was this irrelevant to the site, but the laboratory did not have an adequate database for its interpretation. A more useful reference toxicant would have been lead nitrate. Use of a soluble and bioavailable lead salt would have helped to explain some of the anomalies observed with the sediment samples. ASTM (1993) further recommends a sediment sample spiked with the chemical of concern as a positive control.

- There is no evidence that the control sediment was matched to the sample sediment from the site. ASTM (1993) methods call for matching with respect to TOC, particle size, and pH. Lead does not appear to have been measured in the control sediment.

- Sediment samples were not analyzed with regard to the presence of any chemical with the exception of lead. Factors known to potentially impact benthic organisms such as grain size (except for a gross silt-sand-clay classification) and sulfide content were not analyzed. Moisture content was only measured on oven-dried sediment.

- USEPA did not confirm laboratory toxicity testing by field testing. Since the results from the laboratory were highly equivocal, field measurements of diversity, enumeration, and lead in sediments would have been the necessary to demonstrate toxicity to the benthos. As noted in USEPA guidance (USEPA 1989a), correlation of the abundance and distribution of animals and plants with measurements of concentrations is useful to demonstrate sensitivity and to contribute to the weight of the evidence for ecological risk.

- There are many other stages of the test during which USEPA failed to follow ASTM procedures, failed to document its following of procedures, or failed to demonstrate that modification to the procedure would have no effect on the outcome.

REVIEW OF ECOLOGICAL RISK ASSESSMENT

The risk assessment conducted by USEPA (1993d) does not adequately evaluate potential ecological risks. First, the Agency fails to follow its own guidance with respect to defining assessment endpoints prior to conducting the ecological risk assessment. Second, the ecological risk assessment is based on a conservative and overly simplistic risk assessment model that does not meet the Agency's stated goals for ecological risk assessment. Third, the exposure assessment is based on data that were collected in such a manner as to preclude any true evaluation of ecological exposures and risks. Finally, the overall risk assessment ignores a large body of site-specific data that should be used to support an overall assessment of potential site ecological risks.

Given these limitations, we believe that the ecological risk assessment conducted by the Agency cannot be used to support the remedial objective proposed for lead. Further, we believe that a more complete ecological assessment would show that the NL site does not pose a threat to terrestrial wildlife populations or other receptor populations or communities and that remediation for the protection of wildlife is not be warranted.

Assessment Endpoints

USEPA guidance for ecological risk assessment (USEPA 1989b, 1992) states that an important initial step in ecological risk assessment process is the definition of assessment endpoints[2] that can be used to guide the design, conduct, and interpretation of the ecological risk assessment. According to USEPA (1992), assessment endpoints are the ultimate focus in risk characterization and link the measurement endpoints (the data) to the risk management process. Without an *a priori* definition of the assessment endpoint, there is no context in which to draw conclusions on the significance of the data collected during the ecological

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[2]Assessment endpoints are explicit expressions of the actual environmental variable that is to be protected (e.g., a sport fish population, an endangered species).

study. In these instances, the measurement endpoints become the assessment endpoints upon which the Agency bases its decision. This is in direct contrast to the Agency's own guidance. USEPA's failure to define its assessment goals calls into serious question the overall relevance of its risk assessment and the validity of its final conclusions.

Risk Assessment Model

According to USEPA ecological risk assessment guidance (USEPA 1989a,b), the goal of Superfund ecological risk assessments is to determine the degree to which wastes associated with a particular site have altered the structure, function, or interactions of biological populations and communities or the systems of which they are a part. This goal is consistent with the generally accepted premise of ecological risk assessment (and ecology in general) that effects on individual organisms are not significant unless they result in effects at higher levels of biological organization[3]. USEPA, however, ignores this basic premise in conducting the ecological risk assessment for the NL site, and instead, adopts a risk assessment approach that is designed to evaluate potential effects on individual organisms rather than populations or communities.

The hazard quotient approach used by USEPA does not characterize population or community risks. USEPA uses the hazard quotient approach to characterize potential ecological risks. This approach is based on estimating potential exposures in individual organisms and comparing these to a toxicity criterion. Although valid when used as a screening-level assessment to identify the need for additional study, the hazard quotient approach in and of itself does not constitute a population- or community-level risk assessment. Generally, some type of model (quantitative or qualitative) that links measured responses in individual organisms to population-level or higher responses is needed. USEPA's failure to extrapolate, even qualitatively, the predicted individual organism effects to the population or community level renders the risk assessment meaningless.

Moreover, we believe that had these extrapolations been made, the conclusion of the risk assessment would be that potential lead exposures associated with the NL site will not result in any impacts on wildlife populations or communities. Given the size of the available habitat area (which is considerably less than the 200 acres assumed by the Agency), we believe that it is highly unlikely that the NL study area supports a significant portion of the wildlife populations of the region.

The toxicological endpoints selected by the Agency are not relevant to assessment of population-level effects. Consistent with the overall goal of ecological assessment to evaluate population-level or higher effects, toxicological endpoints that are or can be directly related to population growth, maintenance, or reproduction should be

[3]The exception to this is endangered and threatened species for which the loss of a single individual is regarded as significant. No endangered or threatened species exist at the NL site.

selected for use in the ecological risk assessment. The toxicity endpoints selected by the Agency as the basis for the toxicity values for non-raptor birds, however, are sensitive organism-level endpoints that overestimate the no-observed-adverse-effect-level (NOAEL) or lowest-observed-adverse-effect-level (LOAEL) based on reproduction or other population-relevant parameters. Indeed, according to the Agency, the LOAEL selected for robin and woodcock based on altered blood and brain characteristics in starlings is in fact the NOAEL for reproductive effects. Use of sensitive, organism-level toxicological endpoints in the ecological assessment results in overestimates of potential population-level effects.

Exposure Assessment

The exposure assessment conducted by USEPA does not realistically characterize potential wildlife exposures for the following reasons.

The data collected by USEPA provide a biased estimate of potential exposure. According to USEPA (1992), wildlife exposures should be estimated by combining information on the spatial and temporal distribution of chemicals with that of the ecological receptors being evaluated. USEPA, however, did not define the spatial extent of lead distribution at the NL site. Instead, the Agency used a biased sampling scheme to define categories of lead concentrations at the site rendering the actual distribution of lead at the site unknown. This approach results in a biased overestimate of potential wildlife exposures because only "contaminated" habitat areas at the site are factored into the exposure equation even though other equally habitable areas are likely to have lower lead concentrations.

The analysis of the data collected by USEPA does suggest that the distribution of lead at the site is heterogenous not homogeneous. For example, the data show that high lead levels are localized in West Stream, just south of the railroad tracks and north of Pedricktown Road; lead concentrations in downgradient portions of West Creek and in East Creek are substantially lower. Also, the data show that concentrations vary considerably across very small areas (e.g., within 2 feet). Consequently, exposures could be considerably less than those predicted using data obtained from the biased sampling strategy.

Other approaches adopted by USEPA in the exposure assessment also result in overestimates of exposure. For example, in estimating exposures for each receptor species, USEPA alternately assumes that the entire 200-acre study area contains lead at either less than 1,000 ppm, 1,000 to 2,000 ppm, or greater than 2,000 ppm. Clearly, none of these conditions exist at the NL site. The failure to acknowledge that potentially significant portions of the 200-acre study area have concentrations that fall below these levels results in biased overestimates of wildlife exposures.

The conduct of the earthworm study also results in overestimates of exposure. The exposure regime for the earthworm study was artificially manipulated to increase exposure concentrations by using surficial soils (0-1 inch depth) that were shown to contain the highest lead concentrations. Concentrations in worms present at the site and available as forage would be substantially lower than that observed in the artificially manipulated worm study because worms in the natural environment would also inhabit deeper soils and would be exposed to much lower concentrations overall than were observed within the first inch of soil.

Availability of Other Data

USEPA (1989a) guidance states that ecological assessment is usually based on the weight-of-evidence approach. However, USEPA failed to take into account other data obtained from the field ecological assessment when conducting the ecological risk assessment. Consideration of these other data would support the contention that no ecological risks exist at the NL site. For example, the study with earthworms demonstrated that no correlation exists between mortality and exposure to lead in site soils[4]. Greater survival was observed in worms exposed to 6,800 ppm lead compared to 120 ppm lead, and only a weak correlation between worm weight and lead exposure was noted. Total body and organ (thymus, spleen, testes, uterus, adrenal gland) weights from *Peromyscus leucopus* trapped at various areas on the site did not show any relationship to lead concentrations in soil. These data along with the observations in the *C. tentans* assay do not reveal significant toxicity or impact at lead levels in the thousands of parts-per-million range. We believe that the weight of evidence at the NL site does not support a remediation goal of 500 ppm when the ecological field studies are evaluated.

CONCLUSIONS

We believe that the proposed remedial action objective for lead is not supported by the analyses presented by USEPA. Overall, the results from the toxicity testing are so anomalous and equivocal that they are virtually useless from either an research or regulatory context. USEPA has not adequately demonstrated that lead was the source of toxicity to *C. tentans*, nor has USEPA identified a level of safety for protection of the local benthic community. Further, the ecological risk assessment conducted by USEPA does not evaluate nor demonstrate the potential for impacts on wildlife populations or communities and is based on a biased data set that results in overestimates of potential wildlife exposures. Finally, the Agency ignores a body of evidence that collectively indicates that the proposed 500 ppm remedial objective for lead for the protection of wildlife is not warranted.

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[4]It should be stressed, however, that the earthworm studies also suffered from quality assurance problems and anomalies and, therefore, may be of limited utility in assessing lead toxicity in site soils.

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ATTACHMENT B

COMMENTS ON PROPOSED SOIL WASHING REMEDY AND ALTERNATIVE PLANS

TABLE OF CONTENTS

List of Figures

List of Tables

COMMENTS ON PROPOSED SOIL WASHING REMEDY AND ALTERNATIVE PLANS

1. INTRODUCTION

During the remedial investigation conducted by NL Industries, total lead concentrations of up to 12,700 ppm were detected in on-site soils and concentrations of up to 1,770 ppm were detected in off-site soils. EPA selected a remedial action objective for soil of 500 ppm total lead and a remedy which includes soil excavation, soil washing of hazardous soils, on-site landfilling of nonhazardous soils, and the backfilling of washed soils that meet the remedial action objective into the excavated areas. The 500 ppm remedial action objective will be addressed elsewhere; these comments focus on the proposed remedy and suggest alternatives to that remedy.

2. COMMENTS ON SOIL WASHING TECHNOLOGY

A. INTRODUCTION

In the proposed plan, EPA has selected a remedy which provides for the excavation of all soils above the remedial action objective and subsequent soil washing of all hazardous soils. According to EPA, the preferred alternative satisfies all statutory requirements, including EPA's preference for treatment. EPA also acknowledges that soil washing is an innovative treatment technology and that a treatability study will be performed during remedial design to determine optimum design parameters. EPA's addendum to the final feasibility study report comments that NL is unjustly critical of soil washing, that concerns regarding the applicability of soil washing to the site would be addressed during laboratory, bench, and pilot scale tests, and that information which has been developed by EPA since 1990 suggests significant new developments related to soil washing technologies.

B. REVIEW OF EPA LITERATURE

The NL Pedricktown Site Group has reviewed several EPA publications which have been issued since 1990 related to soil washing.

According to EPA's July 1991 Selection of Control Technologies For Remediation of Lead Battery Recycling

Sites,[1] two sites have unsuccessfully attempted soil washing of lead-contaminated soil. Lee's Farm in Woodville, Wisconsin attempted soil washing with EDTA after brief laboratory and bench-scale testing. This attempt, however, was discontinued when material handling problems became excessive. Basu et al. also reported that EPA's Mobile Soils Washing System (MSWS) was used at the ILCO site in Leeds, Alabama, and was successful in reducing the level of lead in the ILCO soil from 47,000 ppm to 1,300 ppm (e.g., a concentration which exceeds the remedial action objective at the NL Pedricktown site). At the ILCO site, however, severe material handling problems such as fine particles clogging the filter and excessive suspended solids loading to the EDTA/lead recovery system prevented the MSWS from cleaning up the entire site.

Basu et al. also noted that EPA has recently completed a series of laboratory tests on soil and battery casing samples from metal recycling sites to determine, among other things, the feasibility of reducing lead concentrations by soil washing. During these studies, soil samples were subjected to bench-scale washing cycles using water, EDTA, or a surfactant (Tide detergent), respectively. The results of the study indicated that soil washing did not remove significant amounts of lead from any of the soil fractions, causing Basu et al. to comment that the "results did not augur success for battery breaker applications". The Bureau of Mines researchers involved in the project believed that there were a number of problems associated with the field application of EDTA, including the cost of the reagent, the extreme difficulty in filtering sands and silts, the complexity of recycling EDTA, and the variety of EDTA forms required (depending on the prevalence of various lead species).

The U.S. Bureau of Mines has also performed soil washing bench scale treatability studies at three lead battery recycling sites (C&R Battery, VA and United Scrap Lead and Arcanum, OH) using nitric acid.

Basu et al. also reported that Barth and others of EPA have conducted other bench-scale studies of contaminated soils from several battery breaking sites throughout the United States. As part of these studies (which evaluated soil washing as a pretreatment before solidification/ stabilization, EPA investigated

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[1] Basu, T.K., A. Selvakumar, R. Gaire. Selection of Control Technologies for Remediation of Lead Battery Recycling Sites. EPA/540/2-91/014. 1991.

different washes of tap water (pH 7), anionic surfactant (0.5%), and Na_4EDTA (3:1 molar ratio), respectively, at a 10:1 (solution to soil) ratio for a 30-minute contact time. Although the chelating wash solution removed more lead from the raw soil than the tap water or surfactant, the authors concluded that the amount of lead which was removed was insignificant compared to the total lead content and that weathering time impacts the efficiency of separating contaminants from soil.

Basu et al. has summarized some of the disadvantages of soil washing as follows:

- Soil washing and acid leaching are still in the bench-scale developmental stage,
- Soils which are high in clay, silt, and/or humic material have proven difficult to treat,
- Mineralogical characteristics of soil...can have detrimental effects on process reactions and use of reagents,
- Effluents from soil washing systems require further treatment before discharge. If reagents are expensive and are not recyclable, treatment costs will increase, and
- Residuals or sludges generated from the process may require further treatment before disposal or reclamation.

In general, Basu et al. concludes that soil washing technology requires significant development prior to use in large scale application.

C. SOIL PARTICLE SIZE CONSIDERATIONS

According to EPA's Engineering Bulletin-Soil Washing Treatment,[2] particle size distribution is the key physical parameter for determining the feasibility of using a soil washing process to remove contaminants from soils. Although the NL Pedricktown Site Group does not believe that particle size distribution should be the sole reason for choosing or eliminating soil washing as a candidate technology for remediation, it is believed that particle size distribution can provide

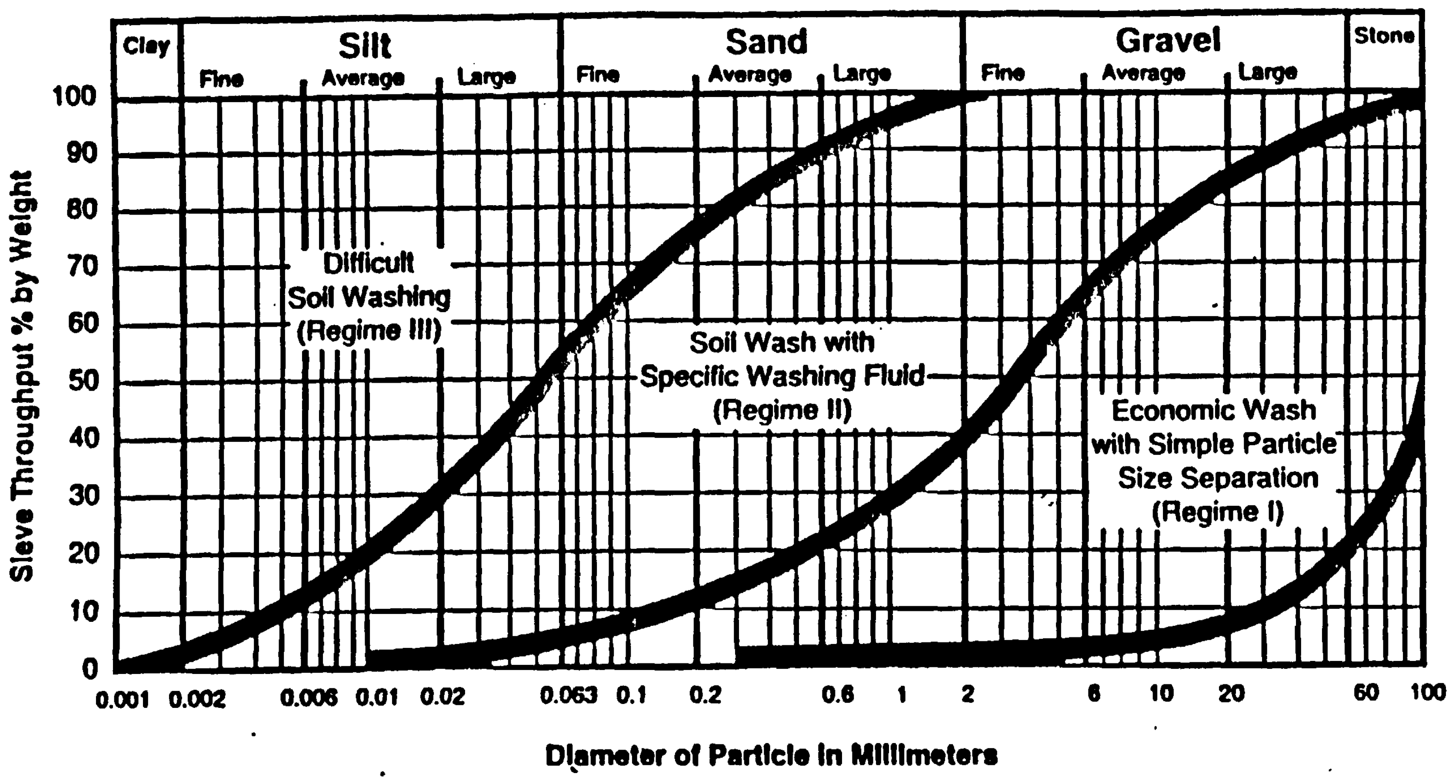
[2] U.S. Environmental Protection Agency. Engineering Bulletin-Soil Washing Treatment. EPA/540/2-90/017. September 1990.

an initial means of screening for the potential likelihood of success using soil washing.

EPA's Engineering Bulletin notes that soil washing is effective on course sand and gravel. Soils containing a large amount of clay and silt typically do not respond well to soil washing, particularly if soil washing is applied as a stand-along technology. Figure 1, excerpted from EPA's Engineering Bulletin, presents a simplistic particle size distribution range of curves that illustrate a general screening definition for soil washing technology. In regime 1 of Figure 1, where course soils are found, the matrix is very amenable to soil washing using simple particle size separation. In regime 3 of Figure 1, however, soils consisting largely of finer sand, silt, and clay fractions, and those with high humic content, tend to contain strongly adsorbed organics that generally do not respond favorably to systems that work by only dissolving or suspending contaminants in the wash solution. Thus, contaminants in soils containing a high percentage of silt and clay-sized particles typically are strongly adsorbed and are difficult to remove.

The NL Remedial Investigation Report suggests that soils at the site are highly variable. For example, on-site soils are characterized by a thin (1-2 inch) layer of top soil containing little plant material over a tannish-brown, sandy soil. In wooded areas, however, a thick (6-8 inch) humus layer is overlaying the soil. The soil under the humus was a tannish to reddish brown, sandy soil. Soils on adjacent agricultural lands have 12 to 14 inches of rich, blackish brown topsoil with an underlying tannish brown, sandy soil. Sediments from the stream may contain lead which is tightly adsorbed to organic materials. The variability of the soils which are planned to be remediated by washing thus adds another element of uncertainty to the proposed remedial technique.

Figure 1
Soil Washing Applicable Particle Size Range



D. KING OF PRUSSIA SITE

The NL Pedricktown Site Group is aware that EPA has selected a soil washing technology for remediation of the King of Prussia (KOP) Technical Corporation Site in Winslow Township, New Jersey. According to information[3] published by Geraghty and Miller, Inc., the process to be utilized at the KOP Site involves removal of bulk over-size material by mechanical screenings, with subsequent screening and separation of coarse- and fine-grained fractions. Hydrocyclones are planned to be used to sep-arate the sands (coarse-grained materials) and the fines (silts and clays). The sands are subsequently planned to be treated by flotation techniques, while the fines are concentrated and dewatered in a dense sludge cake.

Based upon information available to the NL Pedricktown Site Group, it is believed that the process to be utilized at the KOP site involves only the physical separation and processing of on-site materials. Because the EPA has not demonstrated that physical processing will be adequate for the separation and processing of lead contaminated soils at the NL Pedricktown site, the NL Pedricktown Site Group believes that chemical processing will also need to be incorporated into the soil washing process. The chemical treatment process is unproven and the likelihood of successful implementation for Pedricktown soils at a reasonable cost cannot be guaranteed.

E. CHMR STUDY

The EPA addendum to the final Feasibility Study Report places particular significance on a test conducted by the Center for Hazardous Materials Research (CHMR) performed under EPA's Emerging Technology Program with the soils obtained from the NL site, upon U.S. Bureau of Mines studies, and other private evaluations of treatment processes for the extraction of lead from soils. EPA, however, has not demonstrated that soil washing will work. In fact, CHMR was only successful in reducing the lead concentrations in Pedricktown soils to about 1,000 ppm, in excess of EPA's remedial action objective for soils at the site.

The NL Pedricktown Site Group examined a copy of CHMR's

[3] Geraghty & Miller, Inc. Environmental Services. News and Communications. Geraghty & Miller Joint Venture Project Introduces New Soil Washing Technology in the United States. Issued July 1993.

draft final report[4] for the Acid Extraction System (AETS) Technology, developed jointly by CHMR and Interbeton bv, under a grant from the U.S. Environmental Protection Agency. AETS uses hydrochloric acid to remove heavy metals from soils and a proprietary system to regenerate the spent extractant.

The NL Pedricktown Site Group comments related to the CHMR research are summarized as follows:

- The soil used during the CHMR study contained an average initial TCLP concentration of 510 mg Pb/l and an average initial total lead concentration of 26,200 mg/kg. Compared to the samples which were collected and analyzed by NL Industries during the remedial investigation, the soil which was evaluated in the studies performed by CHMR is not representative of "average" site conditions.

- CHMR has confirmed the variability of on-site soils. The soil is sandy, with some clays and a few large particles (greater than 1/8" diameter). The raw soil is reddish in color with some visible clays. (In addition, stream sediments are likely to contain significant amounts of organic materials).

- CHMR screen analysis data, summarized as follows, shows the distribution of lead throughout the different soil fractions:

Mesh	Micron	Weight (g)	% on	Pb (mg/kg)
+ 5	4000	124 on	6.2 %	12,000
+ 9	2190	160 on	8.0 %	12,000
+ 20	841	342 on	17.1 %	34,500
+ 40	420	550 on	27.5 %	34,500
+ 60	250	458 on	22.9 %	34,500
+ 100	149	216 on	10.8 %	34,500
- 100	N/A	160 thru	8.0 %	132,500
			Overall:	33,000

These results indicate that the lead content of

[4] Paff, S.W., B. Bosilovich, and N.J. Kardos. Acid Extraction Treatment System for Treatment of Metal Contaminated Soils. Contract No. CR-815792-01-0. Draft Final Report Issued by CHMR to Exide Corporation, September 1993.

the fines (-100 mesh) was extremely high (over 13%) and that even the coarse fractions of the soil contained appreciable quantities of lead. Thus, soil washing techniques which involve simple physical separation will not be effective. More complex, yet-to-be proven chemical separation techniques would need to be developed in order for soil washing to be demonstrated as an effective remedy for the Pedricktown site.

- CHMR conclusions regarding lead removal from soil are based upon two experiments, the results of which are summarized as follows:

First Experiment:

	Untreated	Extraction 1	Extraction 2
TCLP (mg/l)	520.0	-	5.1
Total lead (mg/kg)	29,200.	1,430.	1,310.

Second Experiment:

	Initial	Final
TCLP (mg/l)	503.0	23.1
Total Lead (mg/kg)	23,200.	1,040.

The results from the experiments do not convince the NL Pedricktown Site Group that attainment of EPA's remedial action objectives for the Pedricktown Site are feasible using this technology.

CHMR attributed the high TCLP values in the soil to problems with rinsing. A confirming test, however, could not be conducted because CHMR had an insuf-ficient volume of soil remaining at the conclusion of the test.

- Based upon CHMR's initial results, CHMR anticipated that improved results could be obtained if a longer soil washing period (e.g., increased residence time) was used. The results of CHMR's residence time studies are summarized as follows:

Residence Time	Total Lead (mg/kg)

5 minute	1,790
10 minute	1,930
20 minute	2,210
30 minute	954
40 minute	1,080

Again, the results of CHMR's experiments do not convince the NL Pedricktown Site Group that attainment of EPA's remedial action objectives is possible.

3. <u>ALTERNATIVE SOILS REMEDIES</u>

A. <u>INTRODUCTION</u>

The NL Pedricktown Site Group has reviewed the remedial options presented in the RI/FS and EPA's proposed plan. For reasons which are detailed in the following sections, the NL Pedricktown Site Group believes that it has developed two remedial strategies which are consistently superior to the soil washing remedy selected by EPA.

B. <u>PROPOSED ALTERNATIVE REMEDY 1 - STABILIZATION/ON-SITE CONSOLIDATION</u>

Proposed alternative remedy 1 consists of on-site stabilization of 12,500 cubic yards of hazardous soil followed by placement of treated material in an on-site consolidation pile. In addition, approximately 14,300 cubic yards of soil which do not exhibit a hazardous characteristic but exceed EPA's remedial action objective would be excavated and placed directly into the on-site consolidation pile.

C. <u>PROPOSED ALTERNATIVE REMEDY 2 - OFF-SITE DISPOSAL OF HAZARDOUS SOILS/ON-SITE CONSOLIDATION OR BENEFICIAL REUSE OF NONHAZARDOUS SOILS</u>

Proposed alternative remedy 2 includes the following activities for the soil types which are expected to be generated during remediation:

- Hazardous soils (estimated volume of 3,750 cubic yards) which fail the TCLP test and the EP toxicity test will be excavated and stabilized to render the soils nonhazardous. The soil will either be stabilized on-site or off-site, based upon a cost effectiveness evaluation to be performed during the remedial design. Stabilized soils will be disposed in an off-site landfill.

- Soils (estimated volume of 8,750 cubic yards) which fail the TCLP test but pass the EP toxicity test will be excavated and transported to an off-site hazardous waste landfill for disposal. EPA land disposal restrictions provide an exemption from treatment (and allow for direct placement) for soils which exhibit a hazardous characteristic based upon the TCLP but which do not exhibit a hazardous characteristic based upon the EP toxicity test.

- Soils (estimated volume of 14,300 cubic yards) which exceed EPA's remedial action objective for the site but do not exhibit a hazardous characteristic based upon either the TCLP or the EP toxicity test will be excavated and either consolidated in an on-site disposal area or transported to the Salem County Landfill or to an alternate municipal waste landfill for use as daily cover.

The NL Pedricktown Site Group's proposed alternatives for soils are compared to EPA's preferred remedy, soil washing, in the following sections.

D. <u>COMPARISON OF PROPOSED ALTERNATIVE REMEDY 1 - STABILIZATION/ON-SITE CONSOLIDATION</u>

The NL Pedricktown Site Group has evaluated its alternative proposed remedies in terms of environmental/public health protectiveness, compliance with required cleanup standards, technical performance, and cost. In addition, the remedies have been assessed in terms of their permanence and their use of treatment to the maximum extent possible.

Proposed alternative remedy 1 satisfies EPA's statutory preference for treatment and is equivalent or superior in performance criteria (see Table 1) to soil washing. Alternative remedy 1 employs proven technology (utilized previously by the NL Pedricktown Site Group for treatment of slag during remediation of operable unit 2 at the site) and avoids the lengthy design period and inherent risks associated with soil washing. The NL Pedricktown Site Group is convinced that alternative remedy 1 can be completed at significantly less cost (estimated in Table 2 to be $5,628,000) than soil washing.

E. COMPARISON OF PROPOSED ALTERNATIVE REMEDY 2 - OFF-SITE DISPOSAL OF HAZARDOUS SOILS/ON-SITE CONSOLIDATION OR BENEFICIAL REUSE OF NONHAZARDOUS SOILS

The NL Pedricktown Site Group's alternative remedy 2 is compared in further detail to EPA's proposed soil washing remedy in summary form in Table 1 and in additional detail in the following discussion.

- Overall Protection of Human Health and the Environment

  Alternative remedy 2 results in the removal of all hazardous soils from the Pedricktown site. Soils which exceed EPA's remedial action objective and are nonhazardous would be excavated and disposed on-site. Alternatively, the nonhazardous soils would be used as daily cover at a local municipal landfill. If the nonhazardous soil can be beneficially reused as daily cover at a local landfill, the remedy avoids on-site habitat destruction for construction of the landfill, long term monitoring and maintenance is not necessary, and the possibility of future reuse of the property for a productive purpose is maximized.

- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

  EPA has specified that the primary ARARs of concern are those which apply to wetland areas (New Jersey Freshwater Wetlands Regulations) and RCRA regulations dealing with the identification, handling, transport, treatment and disposal of hazardous waste. The NL Pedricktown Site Group's alternative remedy 2 will comply with all ARARs and, if all nonhazardous soils can be beneficially reused off-site, further destruction of wetlands (which is required by EPA's proposed remedy) is not required for construction of an on-site consolidation pile.

- Long Term Effectiveness and Permanence

  Since alternative remedy 2 includes plans for the excavation and off-site disposal of all hazardous soils and includes plans for the on-site consolidation or off-site reuse of nonhazardous soils which exceed EPA's remedial action objectives, alternative remedy 2 is superior to all other remedial plans in terms of long-term effectiveness and permanence. If nonhazardous soils can be beneficially reused, future monitoring and maintenance of a new on-site disposal area would not be required. Assuming that contaminated soils may have impacted groundwater, alternative remedy 2 represents a solution which includes removal of source areas and provides for long term protection of groundwater.

- Reduction of Toxicity, Mobility, or Volume Through Treatment

  Although EPA's preferred option is expected to reduce the toxicity, mobility, and volume of contaminants through soil washing, the soil washing process is expected to generate some secondary waste requiring off-site disposal. Assuming the lead from the soil washing is concentrated in a soil/residual volume which is 30% of the original volume of soil which is washed, the soil washing process is estimated to produce approximately 3,750 cubic yards (12,500 cubic yards estimated soil volume to be washed x 30%) requiring stabilization to render the soil nonhazardous for disposal.

  Implementation of alternative remedy 2 would also necessitate the stabilization of approximately 3,750 cubic yards of soil (e.g., soil which fails both the TCLP and EP toxicity test) prior to disposal. In addition, all other nonhazardous soil which exceeds the remedial action objective would be excavated and either consolidated on-site or transported for off-site beneficial use. In this respect, the alternate remedy is superior to EPA's proposed soil washing remedy.

- Short Term Effectiveness

  Alternative remedy 2 may create some short-term impacts to the community in that it will require the off-site transport of soil for disposal and/or beneficial use. EPA's proposed remedy also includes the use of roadways for off-site transport of soil washing residuals for treatment and disposal. Because alternative remedy 2 is expected to be implementable in one work season, the alternative remedy offers an immediate benefit for the protection of human health and the environment at the Pedricktown site.

- Implementability

  Soil washing is an unproven technology and requires treatability studies to determine feasibility and effectiveness. Since the likelihood of successful implementation of the soil washing remedy is not known at the present time, completion in three years, as EPA has projected, cannot be guaranteed.

In contrast, alternative remedy 2 is the easiest alternative to implement using standard excavation and transportation techniques. Alternative remedy 2 could be implemented without the complex treatability studies required by EPA's preferred remedy and would likely be completed during one work season.

- <u>Cost</u>

The NL Pedricktown Site Group has estimated costs of approximately $10,146,000 for implementation of the soil washing remedy (see Table 2). Since soil washing is an unproven technology, can not be guaranteed to work, could require additional costs for treatment or regeneration of soil washing chemicals, and requires developmental work to determine its feasibility and likelihood of success, EPA's costs can only be considered estimates at this time.

Alternative remedy 2 has been estimated to cost $8,397,000 for off-site disposal of hazardous soils with on-site consolidation of nonhazardous soils. If off-site beneficial reuse of non-hazardous soils is feasible, the cost for alternative remedy 2 is approximately $7,659,000 (see continuation sheet of Table 2). Because alternative remedy 2 employs standard excavation, transport, and disposal techniques, actual completion of the project for the estimated cost is believed to be highly probable.

- <u>State Acceptance</u>

Although it is not known by the NL Pedricktown Site Group whether the State of New Jersey will approve EPA's proposed soil washing plan, the NL Pedricktown Site Group anticipates that the State will approve alternative remedy 2 since the remedy involves off-site management of all hazardous soils. In addition, if beneficial reuse of nonhazardous soils is feasible, alternative remedy 2 avoids the destruction of on-site wetlands for the creation of a new disposal area, as contemplated by EPA's soil washing remedy.

- **Community Acceptance**

  During the public meeting held in Pedricktown on August 2, 1993, the mayor of Pedricktown expressed the community's objection to the construction of another on-site disposal area. If beneficial reuse of nonhazardous soils is feasible, alternative remedy 2 would address the community's concerns since all soils in excess of the remedial action objective would be excavated and transported off-site for either disposal or beneficial reuse.

F. SUMMARY

For the reasons detailed above, the NL Pedricktown Site Group believes that alternative remedy 1 (soil stabilization/on-site consolidation) and alternative remedy 2 (off-site disposal of hazardous soils/on-site consolidation or off-site beneficial reuse of nonhazardous soils) are superior to the unproven soil washing remedy proposed by EPA.

Off-site disposal of hazardous soils with either on-site consolidation or off-site beneficial reuse of nonhazard-ous soils provides a lower cost remedy and utilizes proven excavation and handling methods which allow for completion in one work season.

Soil stabilization provides the lowest cost remedy which has already been demonstrated at the site for slag treatment.

T A B L E 1

SOIL REMEDIATION - COMPARISON OF ALTERNATIVES			
EPA CRITERIA	**EPA PROPOSED REMEDY** (SOIL WASHING)	**ALTERNATIVE REMEDY 1** (SOIL STABILIZATION)	**ALTERNATE REMEDY 2** (OFF-SITE DISPOSAL/ON-SITE CONTAINMENT OR OFF-SITE REUSE)
1. Overall Protection of Human Health and Environment	Yes (Uses treatment and containment)	Yes (Uses proven treatment and containment techniques)	Yes (Uses treatment, containment, and beneficial use)
2. Compliance with ARARs	Yes	Yes	Yes (Uses treatment, containment, and beneficial use)
3. Long Term Effectiveness and Performance	Yes (Technology removes lead from soil. Residual levels of lead in soil will remain, assuming treatment is effective, subjecting site to future inspection, maintenance and monitoring).	Yes (Technology results in nonleachable nonhazardous material in on-site consolidation area).	Yes (Plan will result in removal of soil above action level from the site and eliminate need to monitor a new on-site disposal area. An estimated volume of 20,000 tons of soil will be beneficially reused).
4. Reduction of Toxicity, Mobility or Volume Through Treatment	Yes (The soil washing process is likely to generate some secondary waste requiring off-site treatment and disposal).	Yes (Technology utilizes proven treatment technology and results in the generation of nonhazardous waste).	Yes (All soils exceeding the remedial action objective will be excavated and removed from the facility for off-site treatment, disposal, or beneficial use).
5. Short-Term Effectiveness	Not Known (Since soil washing is an unproven technology, a starting date for remediation is not known. Additional time would be required for construction of on-site equipment. EPA has estimated 3 years for implementation).	Yes (Since all soil is managed on-site and there is no use of local roads, there is no short-term impact to the community).	Yes (Of all the remedies which have been evaluated, this remedy provides the opportunity for immediate start-up and prompt completion. Because the alternative remedy could be implemented in one work season, the remedy offers immediate benefit for the protection of human health and the environment. Short-term impacts to the community would involve use of local roads for off-site transport of soil).

SOIL REMEDIATION - COMPARISON OF ALTERNATIVES			
EPA CRITERIA	**EPA PROPOSED REMEDY** (SOIL WASHING)	**ALTERNATIVE REMEDY 1** (SOIL STABILIZATION)	**ALTERNATE REMEDY 2** (OFF-SITE DISPOSAL/ON-SITE CONTAINMENT OR OFF-SITE REUSE)
6. Implementability	Not Known (Soil washing is not a proven technology and requires treatability studies to determine implementability).	Yes (Soil stabilization technology has already been demonstrated at the site. Remedy provides for immediate implementation).	Yes (The elements of the remedy are easy to implement and do not require significant developmental activities or feasibility evaluations).
7. Cost	$10,146,000 (EPA costs can only be considered as estimates, since soil washing is an unproven technology and requires developmental work to evaluate feasibility).	$5,628,000 (Implementation, for slag treatment, has already been demonstrated to be feasible).	$8,397,000 (Off-site disposal of hazardous soils; on-site consolidation of nonhazardous soil). $7,659,000 (Off-site disposal of hazardous soils; off-site beneficial reuse of nonhazardous soils).
8. State Acceptance	Not Known	Not Known	Likely
9. Community Acceptance	Not Likely (During the EPA public meeting, the mayor of Pedricktown expressed serious concerns about the creation of a new on-site disposal area. The community is not likely to accept a proposed plan which allows for creation of a new disposal area).	Not Likely (During the EPA public meeting, the mayor of Pedricktown expressed serious concerns about the creation of a new on-site disposal area. The community is not likely to accept a proposed plan which allows for creation of a new disposal area).	Likely (The alternative remedy is likely to receive community support since all soils above the remedial action objective would be removed from the site for off-site management and for beneficial reuse.

NOTES:
(1) 12,500 cubic yards @ $200/cubic yard
(2) 30% of 12,500 cubic yards @ 1.4 tons/cubic yard @ $200/ton
(3) 70% of 12,500 cubic yards @ $5/ton
(4) 70% of 12,500 cubic yards @ 1.4 tons/cubic yard @ $150/ton
(5) These multipliers were utilized uniformly. Engineering and administration costs would be considerably greater for soil washing as this remedy would require 3 years for completion compared to 6-9 months for off-site disposal.
(6) 12,500 cubic yards @ 1.4 tons/cubic yard @ $50/ton
(7) 12,500 cubic yards x 1.25 @ 1.4 tons/cubic yard @ $5/ton
* See continuation page for potential cost savings associated with off-site beneficial reuse of nonhazardous soils

T A B L E 2

SOIL REMEDIATION - COMPARISON OF COSTS			
	EPA PROPOSED REMEDY (SOIL WASHING/ ON-SITE CONSOLIDATION)	ALTERNATIVE REMEDY 1 (ON-SITE STABILIZATION/ ON-SITE CONSOLIDATION)	ALTERNATE REMEDY 2 (OFF-SITE DISPOSAL/ ON-SITE CONSOLIDATION)
COMMON COSTS:			
Site Work	$ 660,300	$ 660,300	$ 660,300
On-Site restoration	$ 807,500	$ 807,500	$ 807,500
Off-site restoration	$ 109,000	$ 109,000	$ 109,000
On-site consolidation pile	$ 951,500	$ 951,500	$ 951,500*
COMMON COSTS (SITE PREP):			
Road relocation	$ 35,000	$ 35,000	$ 35,000
HASP	$ 20,000	$ 20,000	$ 20,000
Wooded area access	$ 120,000	$ 120,000	$ 120,000
Erosion control	$ 50,000	$ 50,000	$ 50,000
VARIABLE COSTS:			
Treatability	$ 150,000	$ 25,000	---
Mobilization	$ 500,000	$ 150,000	$ 150,000
Soil Washing	$ 2,500,000 (1)	---	---
Solidification/disposal	$ 1,050,000 (2)	$ 875,000 (6)	---
On-site disposal	$ 43,750 (3)	$ 78,125 (7)	---
Direct placed soils	---	---	$1,837,500 (4)
Treated and placed soils	---	---	$1,050,000 (2)
SUBTOTAL	$ 6,997,050	$3,881,425	$5,790,800
CONTINGENCY (25%)	$ 1,749,263	$ 970,356	$1,447,700
ENGINEERING (15%) (5)	$ 1,049,558	$ 582,214	$ 868,620
ADMINISTRATION (5%) (5)	$ 349,853	$ 194,071	$ 289,540
T O T A L	$10,145,724	$5,628,066	$8,396,660*

NOTES:
- (1) 12,500 cubic yards @ $200/cubic yard
- (2) 30% of 12,500 cubic yards @ 1.4 tons/cubic yard @ $200/ton
- (3) 70% of 12,500 cubic yards @ $5/ton
- (4) 70% of 12,500 cubic yards @ 1.4 tons/cubic yard @ $150/ton
- (5) These multipliers were utilized uniformly. Engineering and administration costs would be considerably greater for soil washing as this remedy would require 3 years for completion compared to 6-9 months for off-site disposal.
- (6) 12,500 cubic yards @ 1.4 tons/cubic yard @ $50/ton
- (7) 12,500 cubic yards x 1.25 @ 1.4 tons/cubic yard @ $5/ton
- * See continuation page for potential cost savings associated with off-site beneficial reuse of nonhazardous soils

T A B L E 2 (continued)

SOIL REMEDIATION - COMPLETION OF COSTS		
	ALTERNATIVE REMEDY 2 (OFF-SITE DISPOSAL WITH ON-SITE CONSOLIDATION)	ALTERNATIVE REMEDY 2 (OFF-SITE DISPOSAL WITH OFF-SITE BENEFICIAL REUSE)
Surface preparation	$ 37,000	---
Disposal	$147,500	$147,500
40 ml liner	$ 79,000	---
Drainage layer	$ 14,000	---
Root zone soil	$ 87,000	---
Top soil	$ 28,000	---
Seed, fertilizer, etc.	$ 9,000	---
Liner system	$550,000	---
SUBTOTAL	$951,500	$147,500
CONTINGENCY (25%)	$237,875	$ 36,875
ENGINEERING (5%)	$142,725	$ 22,125
ADMINISTRATION (5%)	$ 47,575	$ 7,375
T O T A L	$1,379,675	$213,875

NOTE: The information presented above summarizes the two options associated with alternative remedy 2. If nonhazardous soils which pass the TCLP but exceed the EPA remedial action objective are able to be beneficially reused at a local municipal landfill, this option would result in removal of all contaminated soils from the site, would result in additional cost savings, would preclude the construction of a landfill in two acres of wetlands, and could save the county approximately $500,000 in purchase costs for daily cover.

ATTACHMENT C

REVIEW AND COMMENTS ON GROUNDWATER INVESTIGATION AND REMEDIATION STRATEGIES

NL INDUSTRIES SUPERFUND SITE OPERABLE UNIT ONE PEDRICKTOWN, NEW JERSEY

15 September 1993
3520701

Langan
Engineering and Environmental Services, Inc.

REVIEW AND COMMENTS ON GROUNDWATER INVESTIGATION AND REMEDIATION STRATEGIES

NL INDUSTRIES SUPERFUND SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

Prepared by:

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15 September 1993
3520701

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

This report summarizes the review of technical and administrative documents which pertain to the groundwater investigation and proposed groundwater remediation at the N.L. Industries Superfund Site, Operation Unit One, Pedricktown, New Jersey. The objective of the review was to understand site groundwater conditions, as defined in the Remedial Investigation (O'Brien & Gere, 1991), to develop a conceptual technical approach which would best address the remediation of groundwater, to review the Feasibility Study (O'Brien & Gere, 1993) and Proposed Plan (U.S. EPA, 1993), and to evaluate the EPA-selected remediation strategy. This technical assessment included a review of those documents from the Superfund Document Record which were made available to Langan, and which constitute the basis for the selection of the preferred remediation strategy. These documents are listed in Appendix A.

The organization of this report is similar to that in the U.S.EPA Proposed Plan (July 1993). This organization is intended to facilitate preparation of responses to the Proposed Plan, and to provide a logical progression through the technical discussions.

Overall, we conclude that the groundwater remediation preferred by EPA in its Proposed Plan is inappropriate. The data and assumptions that were used to formulate the preferred remediation strategy likely do not represent actual conditions in the shallow aquifer, and the proposed groundwater recovery system is not appropriate to address the potential problem. The proposed plan fails to demonstrate whether the recovery of inorganic compounds from the shallow aquifer matrix is possible, using a groundwater extraction technique, even though such an evaluation could have been conducted using simple rapid field tests (typically less than ten days of field time). We further conclude that the Proposed Plan is invalid because it fails to consider whether the proposed soil remediation would also remedy any problems associated with groundwater quality.

2.0 COMMENTS ON REMEDIAL INVESTIGATION

Our review of the Remedial Investigation (RI) focussed on the interpretations of aquifer conditions and groundwater quality, and on how these interpretations were used in, and affected the decisions in, the Feasibility Study and Proposed Plan, as related to groundwater. Our technical assessment concluded that the Remedial Investigation:

- Demonstrated that the zone of contamination is limited, consists generally of concentrations of target compounds which marginally exceed groundwater quality standards and has not impacted off-site areas.

- Failed to correlate the extent and distribution of contamination in the shallow aquifer with soil remedial investigation findings and failed to consider potential continuing residual sources in soil.

- Demonstrated that the compounds of concern are not mobile, and that the zone of contamination is not expanding over time. Some data indicate it might be decreasing.

- Failed to provide an adequate characterization of either the shallow unconfined aquifer or the actual connection with lower aquifer systems, and failed to explore potential mechanisms to explain the behavior of the target compounds in groundwater.

The RI demonstrated that the zone of contamination in the shallow, unconfined aquifer is limited and restricted to the vicinity of former process/operations areas. Despite this demonstration the RI concluded that these compounds are present in a mobile plume which flows approximately parallel to the groundwater flow direction. This conclusion does not agree with groundwater monitoring results which did not detect target compounds in downgradient or off-site wells.

The authors of the RI attribute the groundwater contamination to recharge from areas where slag piles were staged. This explanation can not account for either the distribution or extent of compounds in the impacted zone, which are present at low concentrations over a large area, or for higher concentrations at two specific, and limited locations. These locations do not correspond to the locations of the former slag piles. Furthermore, this explanation does not account for the distribution of residual compounds in soil, which is similar to that in groundwater, and which does not indicate contamination from localized sources. Rather, the distribution in unsaturated soil (Figure 8 of the RI) and in groundwater (Figure 33 of the FS) can be correlated very well, demonstrate a non-point source distribution, and indicate a continuing discharge to the shallow aquifer from residual soil contamination over a large and diffuse area. This issue is discussed in greater detail in our comments on the Feasibility Study - Section 3.0 of this report.

The RI demonstrated that the target compounds are not mobile within the shallow aquifer, but still concluded that the contaminated zone represents a "plume." The term "Plume" implies a region of contamination which originates at one or more source areas and migrates, through various mechanisms, within the aquifer. This designation is difficult to reconcile with the groundwater data, and with the interpretations in the RI which conclude that "...[t]he current limited extent of contamination *relative to predicted groundwater flow* (emphasis added) demonstrates that the migration of chemicals within the ground water is being impeded..." (RI - pg. 57). In other words, the compounds within the contaminated zone are not actually moving. The RI also concluded that the contamination in the shallow, unconfined aquifer has not measurably impacted either the first or second confined aquifer, and there has been no impact to potential off-site receptors.

The RI did not include tests or analyses to determine aquifer characteristics, or to explain the behavior of target compounds in the shallow aquifer. Although the RI recognizes the limitations of the existing groundwater database, and recommends additional investigation, which includes installation of additional monitoring wells, replacement of some existing monitoring wells and resampling of all wells, these recommendations have not been implemented. This is of particular importance because the data upon which the ultimate remediation strategy will be decided was generated in 1989 (four years ago). In the intervening time, groundwater conditions and quality might have changed significantly. We note this as a concern because there were significant decreases in the concentrations of sulfates and filterable lead reported for monitoring wells on the northern section of the site during the period 1983 -1988. Further decreases occurred between the 1988 and 1989 monitoring episodes.

The RI includes no discussion or explanation for these decreases, and does not attempt to explain the presence of the particular suite of compounds which characterize the contaminated zone. The authors of the RI intimate that sulfates are an indicator parameter of the contamination, but an explanation of its presence is not provided. Neither is an attempt to correlate the sulfates with other indicators such as pH, TDS, TSS, turbidity, or target inorganic compounds. We speculate that the presence of sulfates could be related to battery acid (H_2SO_4 - Sulfuric Acid) which has been partially neutralized in the soil environment, where sulfuric acid combines with water, oxygen and humic acid (H_2CO_3) to produce water, carbon dioxide and the soluble sulfate anion (SO_4).

The important issue, however, is that similar decreases in these parameters could have occurred in the ensuing four years, and current groundwater conditions and quality could be very different than presented and predicted in the RI.

Another issue which might be resolved with current groundwater quality data is whether the presence of lead in groundwater around the RCRA landfill might be related to a former leachate back-up and overfill, and whether the subsequent maintenance of the collection system has resulted in an improvement to groundwater quality in this area.

3.0 COMMENTS ON FEASIBILITY STUDY

Our comments on the Feasibility Study (FS) focus on the relevance of the assumptions used in the evaluation of potential remediation strategies, and consider both technical and regulatory issues which will affect the ultimate strategy selection. We reviewed the FS prior to the U.S. EPA Proposed Plan to avoid preconceived bias from the EPA recommendations and remediation strategy selection.

Our review and assessment of the Feasibility Study concluded that:

- The study did not include an assessment of the recovery potential of the compounds of concern from the shallow aquifer.

- The conceptual remediation design did not include a groundwater extraction-recovery system designed to address the documented zone of contamination.

- The assessments of remediation strategies were conducted without understanding the source(s) of the contamination, and did not consider the potential effects on groundwater quality of the remediation of the overlying, contaminated soil.

- The effects on groundwater quality of source (soil) remediation were not evaluated, even though such an evaluation could have been completed in less than ten days using simple field tests.

- The proposed pumping rates for the recovery-treatment system are unrealistic and do not consider aquifer capacity.

The FS does not evaluate the technical feasibility of the remediation of the shallow, unconfined aquifer, in that it does not assess whether the physical extraction/recovery of the compounds of concern from the aquifer is possible. Tests to evaluate the recoverability of the inorganic compounds are not included in the study. Rather, it is limited to an evaluation of potential treatment and discharge options for (theoretical) groundwater intercepted at the perimeter of the site, which is likely not similar in composition to actual groundwater in the contaminated zone.

Throughout the FS it is assumed that the compounds are distributed homogeneously in the aquifer, and that they are in a dissolved state and completely recoverable. This assumption has no basis in technical fact, and is difficult to reconcile with the conclusion in the RI that lead (and possibly other compounds) is not a mobile species as a result of some natural process(es) which arrests possible transport mechanisms. Neither O'Brien and Gere nor the EPA offered an explanation of the mechanism through which pumping groundwater would mobilize non-mobile compounds. In the absence of these evaluations, and the resultant conclusions, none of the potential remediation strategies can be considered feasible.

The proposed use of the existing interceptor wells as a recovery system, rather than for their intended purpose as an interceptor network, is a solution of convenience which fails to address actual conditions. This proposed recovery system would result in an aggregate treatment and discharge capacity of 360,000 gallons per day. Because the extraction points are located around the outer perimeter of the site, we note that approximately 55% of that water (193,000 gpd) would be from off-site or from areas outside the contaminated zone, as defined in the RI. (Our calculations and rationale for this estimate are included in Appendix B.) The FS did not include a design for a groundwater extraction system to recover groundwater specifically from the contaminated zone, nor did it consider alternative interceptor system designs, which might require lower pumping rates to control groundwater flow.

The FS does not consider the source(s) of the groundwater contamination, or the potential effects of source removal on long-term aquifer quality. The distribution of inorganic compounds in shallow groundwater and the interpretation of migration potential in a plume (FS - Figures 33 through 36) is the key issue upon which the conclusion that aquifer restoration is possible is based. The FS postulates that the immobile inorganic compounds are migrating parallel to groundwater flow in the shallow, unconfined aquifer in a southeast to northwest direction (Figure 33). We question whether this distribution represents a plume, or rather the introduction into the aquifer of a vadose solute from soil contamination throughout the area, such as lead-bearing battery acid. Comparison of Figure 8 of the RI and Figure 33 of the FS (revised and attached as Figures 1 and 2) shows a strong correlation between the distribution of lead in soil and the location of the lead-bearing zone in the upper, unconfined aquifer. In speculation, this latter scenario could account for the decrease in filterable lead between 1983 and 1988 (four years after cessation of facility operations), and also for the absence of migration (acid precipitation neutralized in a pH-normal aquifer).

The FS fails to discuss the possible effects of the removal of the source(s) on groundwater quality, and a proposal to evaluate such effects. Such an evaluation can be accomplished in less than ten days using a simple, rapid field test, which would demonstrate whether there is a continuing discharge from a soil source. This testing would define the leachate production and infiltration rates, would demonstrate the fate of the leachate and explain the behavior of compounds within the shallow aquifer, and would determine whether the proposed recovery of inorganic compounds is possible.

The evaluation would begin by conducting the groundwater investigation tasks proposed in the RI to supplement the existing data base. At the same time, Suction Lysimeters would be installed in the unsaturated zone at select locations to collect vadose water from suspected source areas. Samples from the saturated and unsaturated zones would then be analyzed for total metals, filterable metals, TDS, TSS, pH, and sulfates. Data from the two media would be compared to determine whether there is potential contaminant communication between soil and groundwater.

Based on these initial data, the monitoring network would be refined, as necessary, and both media would be monitored after a rainfall, to establish the (suspected) causative link between the systems. Monitoring episodes would be conducted before and following precipitation events to estimate the leachate loading rate to the aquifer and to determine the fate of the leachate in the aquifer.

In addition to these observations and analyses, a field extraction (pumping) test, would be conducted to determine the recovery potential of the compounds from the shallow aquifer over time. This would consist of groundwater extraction from a well at the location of highest lead concentration. The well would be pumped at a rate determined during a preliminary well performance test, and would be set to ensure equilibrium flow over a three-day period. Samples would be analyzed from the discharge stream at regular time intervals to determine whether dissolved compounds continue to be released into the aquifer under pumped conditions over time. The test would also be used as an opportunity to collect hydraulic data about the aquifer. If necessary, these data would then be used for the design of a proper groundwater recovery system after soil sources are removed. An additional similar demonstration of the recovery potential of the existing interceptor system could also be performed at this time.

The treatment system discharge options considered in the FS are evaluated using an assumed flow rate which is unrealistic, and which has no technical basis. For each option, a total (aggregate) flow/discharge rate of 250 gallons per minute (gpm) is assumed. This volume was selected arbitrarily by assuming that the groundwater recovery system would consist of the 49 existing site-perimeter interceptor well points, which would be pumped at 5 gpm each. Apart from assuming that each of the wells could sustain this discharge rate under long term pumping, there is no justification for using all of the interceptor points, some of which are greater than 600 feet from the edge of the "plume," and are not down gradient. The locations of the well points in relation to the estimated edge of the contaminated zone are depicted on Figure 3. More importantly, as specified in Section 1.2.3.2. of the FS (page 17), the well point system "... was designed to prevent off-site migration of contaminated groundwater." Later in the FS (Section 3.3.2, page 57) this same system is proposed to "...recover groundwater and limit off-site migration..." which, as documented in the RI and in the Proposed Plan, is not now occurring.

By considering only the recovery/treatment system described above, the remediation strategies which would involve the re-introduction of treated groundwater back into the shallow aquifer were eliminated from the list of viable alternatives. We contend that all of those groundwater discharge options are not only feasible, but preferable if a lower flow/discharge rate is applied. This modified remediation strategy would include an extraction or interceptor system designed and located to recover contaminated groundwater from a well defined zone within the aquifer. We reiterate, however, that even this modified system should not be considered unless the recovery potential of the target compounds is documented, and should be proposed only as a contingency if the removal of the (suspected) source(s) of the continuing discharges (soil) does not result in an improvement in groundwater quality.

4.0 COMMENTS ON U.S.EPA PROPOSED PLAN

Our comments in the previous sections of this report respond to those sections of the Proposed Plan which summarize the documents prepared for the selection by U.S.EPA of remedial strategies. This section presents our observations and comments on the EPA selection criteria, and the technical basis for selection of the preferred option. Our review of the Proposed Plan was completed only after we had reviewed the RI and FS reports and had formed our own interpretations and conclusions, independently of the EPA selection.

The Proposed Plan relies on data and interpretations from the RI and FS which are either flawed or incomplete, and which do not present an adequate assessment of site conditions upon which to base long-term remediation decisions. The bases for this conclusion include:

- The remedial strategy selection is based on the premise that there is a "...substantial and imminent threat to public health..." which is contrary to the findings documented in the RI and re-stated in the Proposed Plan.

- The Proposed Plan does not consider the potential positive effects on aquifer quality of the remediation of overlying, contaminated soil.

- The Proposed Plan proposes to restore site groundwater quality by using an interceptor system that was designed only to prevent off-site migration.

- The conceptual groundwater remediation strategy includes restoration of a non-use aquifer to groundwater quality standards (for primary drinking water sources) as a means to protect a public which, as agreed to by EPA in the Proposed Plan, is not now being exposed.

- The Proposed Plan does not consider the recommendations in the RI for additional investigation, or those in the FS, that remediation options which include re-introduction of the treated groundwater to the aquifer should be evaluated further. The final selection is made despite this lack of information.

The requirement to remediate groundwater is based on the conclusion that there is a risk to public health and the environment. In particular, EPA has assessed this potential risk assuming that future uses of the site could include residential development, despite its industrial zoning, and despite the deed noticing mechanism used frequently by NJDEPE to minimize or eliminate exposure by restricting future land use options. We note in particular the Summary of Risks paragraph on page 9 of the Proposed Plan, which states that "...groundwater...pose(s) an imminent and substantial threat to public health...." presumably through ingestion of groundwater. We question this conclusion considering there has been no off-site impact to groundwater, and no measurable impact to other aquifers by the contamination at the site.

An evaluation of the potential effects of soil remediation should be considered. Therefore, we recommend that future discussions and/or references to potential long-term active aquifer restoration efforts should be in terms of a contingency plan. Considering the existing aquifer conditions, and the demonstrated minimal exposure potential, and considering that groundwater contamination is likely the result of ongoing releases into the shallow aquifer from residual soil contamination throughout the impacted area, there is no justification to require aquifer restoration using a groundwater extraction strategy, without first evaluating the effects of soil (source) remediation on groundwater quality. An appropriate groundwater remediation strategy would be designed and implemented only if source remediation does not result in a decrease in dissolved compound concentrations in the impacted saturated zone, and that compounds in the aquifer become demonstrably mobile, and threaten an exposure to a potential receptor.

The plan proposes to restore site groundwater quality by using an interceptor system that was designed only to prevent off-site migration. This proposed misapplication of the interceptor system would result in pumping groundwater from outside the zone of contamination on-site. Consequently, the feasibility study on which the Proposed Plan is based is significantly, if not fatally, flawed in it's evaluation of groundwater recovery and treatment system options.

Much of the decision of remediation technology feasibility and selection should be predicated on the definition of the extent of the contamination which must be remediated to comply with groundwater quality standards. In other words, the decision of whether to address all locations where lead concentrations in groundwater exceed 10 ppb (New Jersey Groundwater Quality Criterion), or whether some other concentration is appropriate, must be made before the technical feasibility of any option can be assessed. In the Proposed Plan, the remediation objective is a complete restoration of aquifer quality, using the practical quantitation limit for lead (5 ppb) as the numeric objective. The NJDEPE has a mechanism which will allow interim exceedence of this standard, however, by establishing a Classification Exception Area (N.J.A.C. 7:9-6.6). This would allow discharge of treated water back to the aquifer at higher concentrations than the standard. The Classification Exception Area is granted only through the duration of the remediation period, after which the existing standard will again be applicable. The ultimate goal would be the restoration of the aquifer to the applicable standard(s), if technologically feasible.

By obtaining a Classification Area Exception a groundwater recovery system could be designed to address only those portions of the aquifer with significant contamination, and the re-introduction of the treated water could be a viable option, based on the lower flow/discharge rates, and/or by establishing an exemption zone. In this way, a treatment system which is capable of reducing concentrations to the MCL(s) could be installed, but operated under a New Jersey Aquifer Classification Exemption to treat and discharge back to groundwater, at significantly higher concentrations. The aquifer would be monitored over time to demonstrate remediation performance, and to evaluate and/or reconsider the ultimate remediation objectives.

The Proposed Plan presents the U.S.EPA selection of a remediation strategy despite the lack of the additional data and analyses recommended in the RI and FS. The RI recommended additional groundwater investigation to better characterize aquifer conditions and the nature and extent of the contaminated zone. The FS recommended further evaluation of the remediation alternatives which include the re-introduction of treated groundwater back into the aquifer, because they are viable options. Neither of these sets of recommendations were implemented, but the Proposed Plan culminates in a recommendation for a single preferred strategy.

5.0 CONCLUSIONS AND RECOMMENDATIONS

We conclude that the groundwater portion U.S.EPA Proposed Plan is flawed in that the data used to formulate the remediation strategy likely do not represent actual conditions in the aquifer.

We conclude that the Proposed Plan is invalid because the selection of the treatment and discharge methods was predicated on unrealistic assumptions regarding the capacity of both the groundwater recovery and treatment systems.

We conclude that the FS is incomplete in that it does not evaluate, or even address, the recovery potential of site specific target compounds, and has not proposed a groundwater extraction/recovery system designed to address the zone of contamination , as defined in the RI.

We agree with the conclusions in the RI that the target compounds present in the shallow aquifer are not mobile, but we disagree that their presence represents a "plume" of contamination which is migrating parallel to the general groundwater flow direction. We conclude that the presence of these compounds is more likely the result of non-point source discharges from residual soil contamination. We also agree with the recommendations in the

RI that additional investigation of groundwater conditions and quality are required, and note that the Proposed Plan was prepared without the benefit of such additional data.

We conclude that removal of source area(s) in the overlying unsaturated soil would likely result in an improvement in groundwater quality over time, without active remediation of the aquifer.

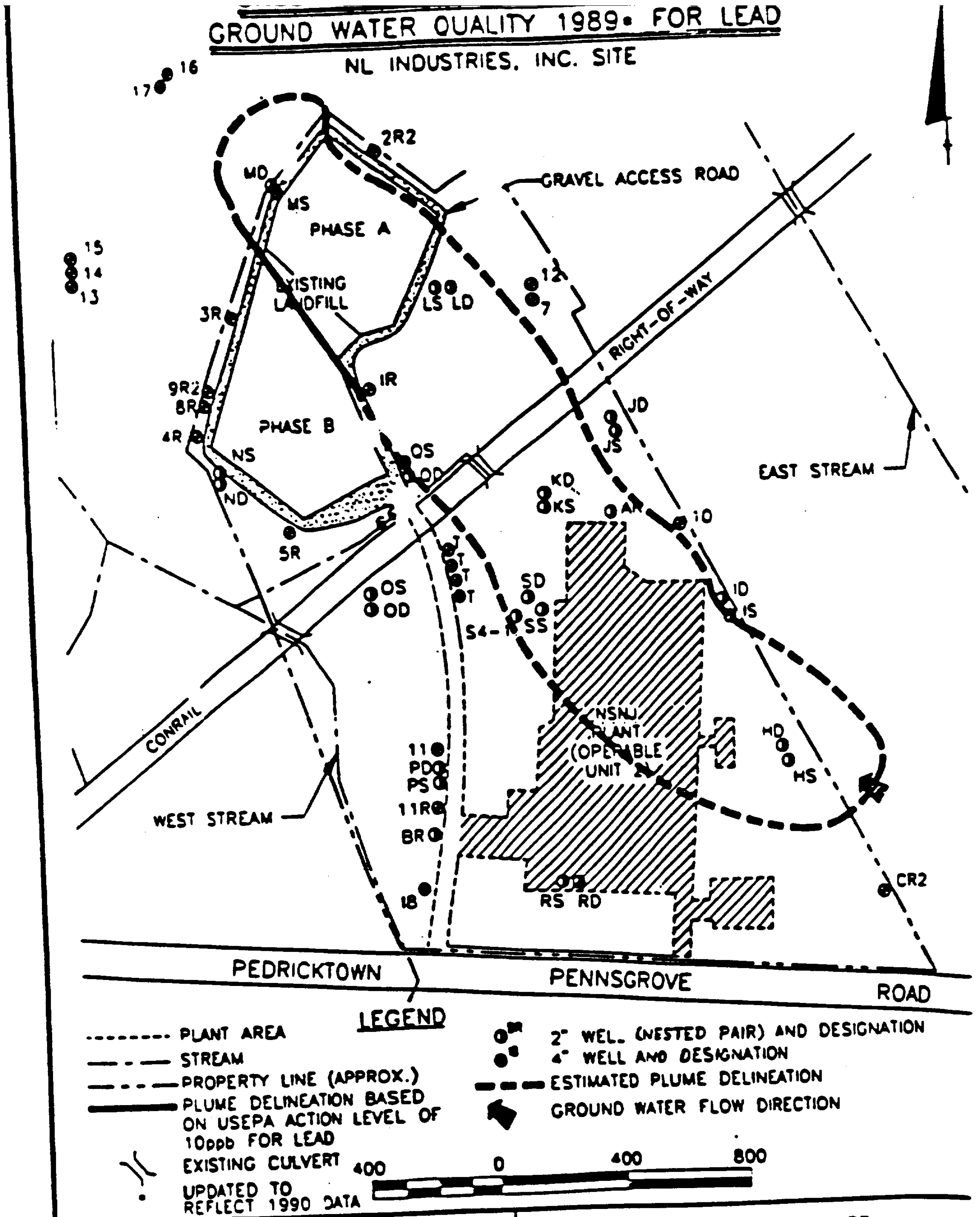
We recommend a field testing program to demonstrate whether there is a continuing soil source of groundwater contamination.

We recommend a re-evaluation of the quality of groundwater in the shallow aquifer to confirm the results of the previous monitoring episodes, and to refine the estimate of the extent of the contaminated zone and the distribution of contaminants within the aquifer.

We recommend determination of the recovery potential of inorganic compounds from the aquifer by using an extraction test, as discussed in this report.

Considering this summary and conclusions, we do not agree that long-term groundwater remediation is necessary *a priori*, and recommend that first the effects of the remediation of contaminated soil on the aquifer quality should be demonstrated. This would involve a redefinition of the impacted area by a baseline groundwater quality monitoring episode, monitoring water quality throughout the contaminated zone (current definition) after the contaminated soil is excavated. Monitoring would permit evaluation of the effects of source removal, and would confirm that contamination is not migrating from the site. During the monitoring period, changes in aquifer quality would be evaluated at regular intervals and the ultimate remediation objectives would be reviewed, reconsidered, and revised, as necessary. We recommend that a monitoring period of two years following soil (source) removal, with quarterly sampling episodes, would provide the necessary data. If groundwater quality does not improve during the monitoring period, or if the compounds begin to migrate toward an off-site receptor, the need for groundwater remediation would be re-assessed, and would consider the findings of the additional investigations recommended in the RI, the FS, and in this report.

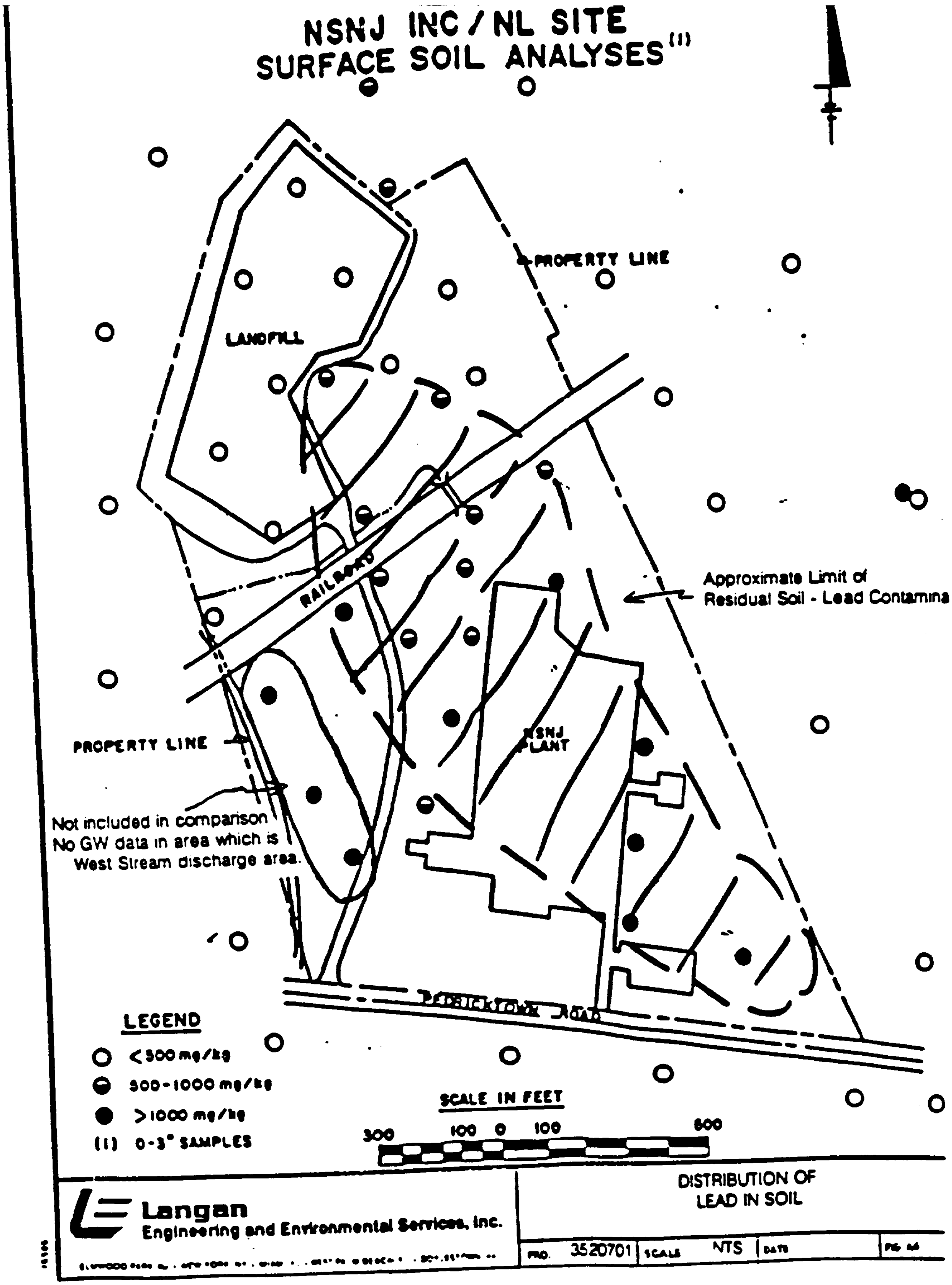
FIGURES

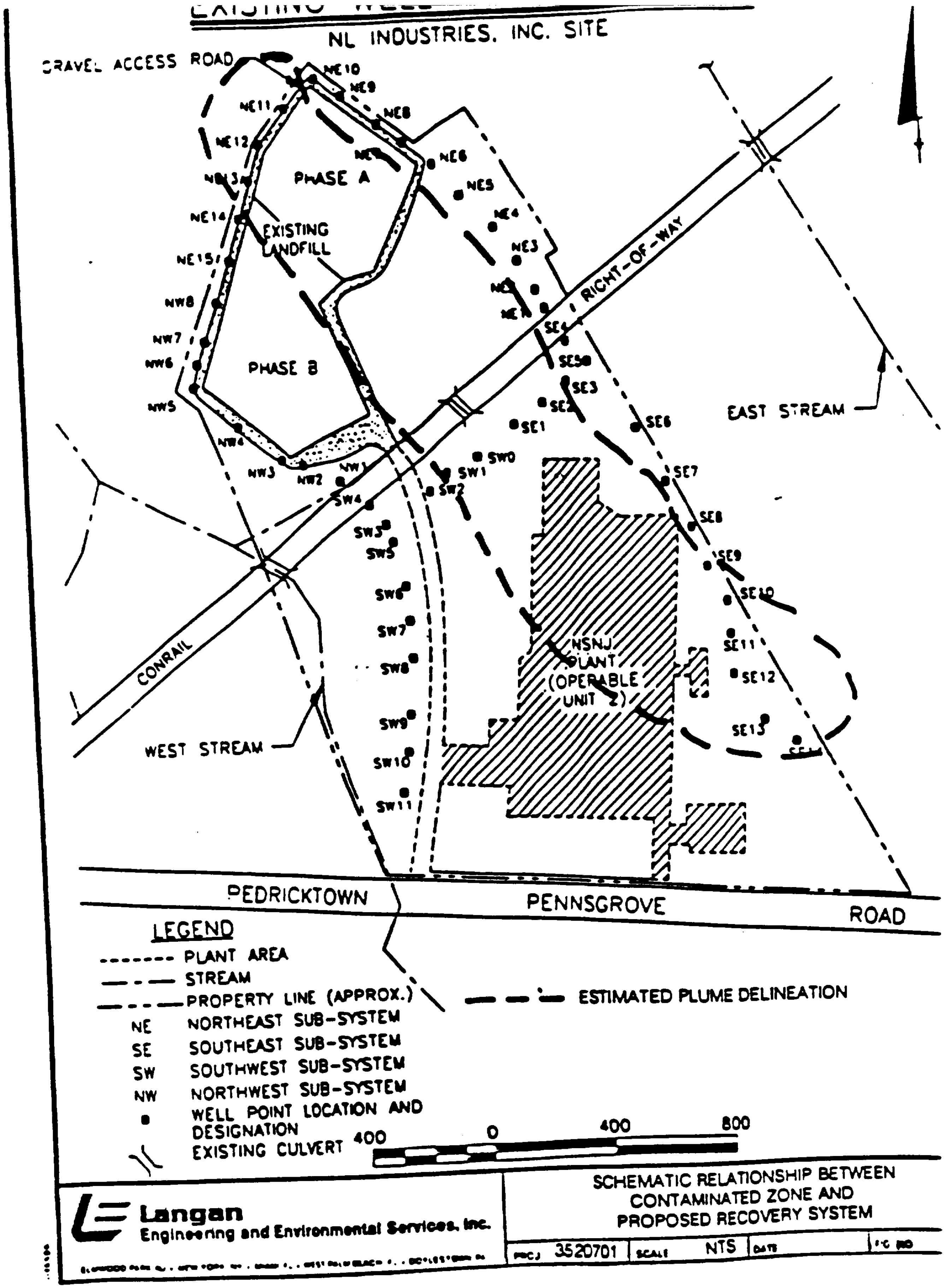


Langan Engineering and Environmental Services, Inc.

ESTIMATED EXTENT OF GROUNDWATER CONTAMINATION

PROJ. 3520701 SCALE NTS DATE FIG NO


NSNJ INC / NL SITE
SURFACE SOIL ANALYSES (1)
PROPERTY LINE
LANDFILL
RAILROAD
Approximate Limit of
Residual Soil - Lead Contamina
PROPERTY LINE
NSNJ
PLANT
Not included in comparison
No GW data in area which is
West Stream discharge area.
PEDRICKTOWN ROAD
LEGEND
<500 mg/kg
500-1000 mg/kg
>1000 mg/kg
(1) 0-3" SAMPLES
SCALE IN FEET
300 100 0 100 500
Langan
Engineering and Environmental Services, Inc.
DISTRIBUTION OF
LEAD IN SOIL
PRO. 3520701
SCALE NTS
DATE
FIG. NO.


NL INDUSTRIES, INC. SITE
GRAVEL ACCESS ROAD
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Langan
Engineering and Environmental Services, Inc.
SCHEMATIC RELATIONSHIP BETWEEN CONTAMINATED ZONE AND PROPOSED RECOVERY SYSTEM
PROJ 3520701
SCALE NTS
DATE
FIG NO

NLI0022437

APPENDIX A

APPENDIX A

DOCUMENTS REVIEWED

PEDRICKTOWN OU-1 SUPERFUND PROJECT
GROUNDWATER INVESTIGATION - REMEDIATION
DOCUMENT REVIEW LIST

Document Title

Remedial Investigation, National Smelting of New Jersey, Inc./NL Industries, Inc. Site
March 1991 - O'Brien and Gere
Vols: I, Report, Tables, Figures
II, Appendices, Exhibits
III Appendices R-U
IV Appendices V-W

Final Feasibility Study - NL Industries, Inc. Site
1993 - O'Brien and Gere

Addendum to the Final Feasibility Study Report
NL Industries, Inc. Superfund
Operable Unit One
(Undated - No preparer Listed)

Superfund Proposed Plan
NL Industries, Inc.
Operable Unit One
U.S. EPA - July 1993

APPENDIX B

APPENDIX B

EVALUATION OF THE EFFICIENCY OF USING INTERCEPTOR WELL NETWORK AS A GROUNDWATER RECOVERY SYSTEM

Langan estimates that of the proposed 360,000 gpd which would be extracted, approximately 193,000 gallons (55%) would be from areas outside the contaminated zone. The basis for that estimate is presented below.

The locations of the existing perimeter-interceptor well points are depicted on the accompanying figure. Also shown is the extent of the contaminated zone, as of 1989.

Using the interceptor well spacing as our guide, we assumed a radius of influence for each well of approximately 60 feet. Each radius was drawn, and the combined zone of drawdown was superimposed on the figure (shaded area).

Because many of the wells are not aligned along the hydraulic gradient with the contaminated zone, their capture zone would include groundwater from outside the contaminated area. Our estimate of the actual capture potential of each well, expressed as a percentage of water pumped, is provided in the ensuing table.

Well Nos.	Percentage of Uncontaminated Water	Volume (gpd)
NE 11-13; SW-1; SW-0; SE 1; SE-2; SE 9-14	0	0
NE 1-10; SE 3-8; SW 2; NE 14	50	64,800
NE 15; NW 1-8; SW 3-11	100	129,600
	TOTAL	194,400

Total volume / 24 hours = 352,800

Total from Uncontaminated = 194,400 = 55%

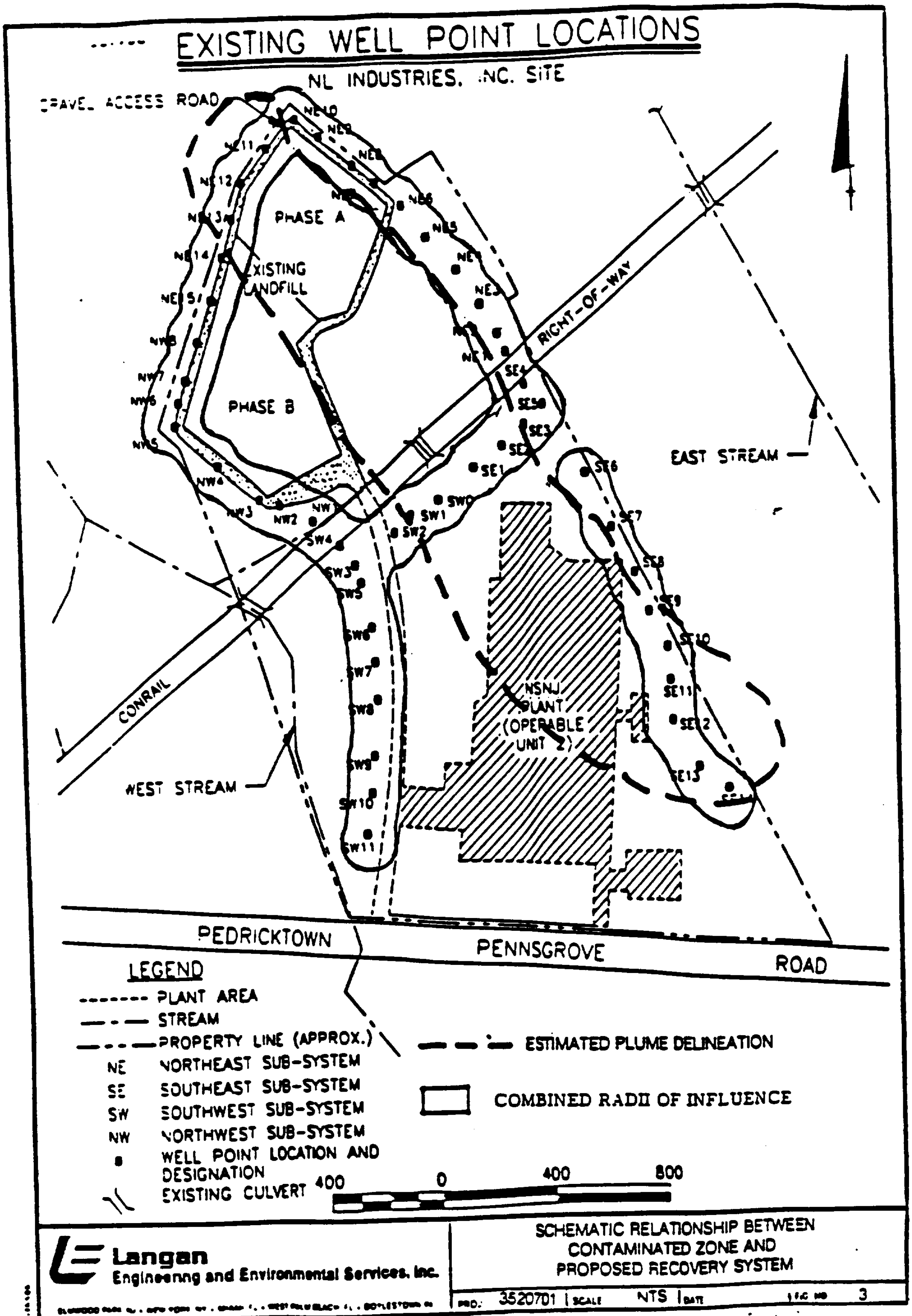
Total from Impacted Area = 158,400 = 45%

Because of dilution, it is not possible to estimate the influent concentrations, and of equal difficulty to design a treatment system of the proper capacity and operation specifications.

Efficiency of Proposed Recovery System Pedricktown OU-1: G.W. Remediation	BY TPG DATE 08-09-93 CKD ____ DATE ____	PROJ NO 3520701 SHEET 1 OF 2

Langan

NLI0022443


EXISTING WELL POINT LOCATIONS
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SW SOUTHWEST SUB-SYSTEM
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Engineering and Environmental Services, Inc.
SCHEMATIC RELATIONSHIP BETWEEN
CONTAMINATED ZONE AND
PROPOSED RECOVERY SYSTEM
PROJ. 3520701
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FIG NO 3

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APPENDIX B

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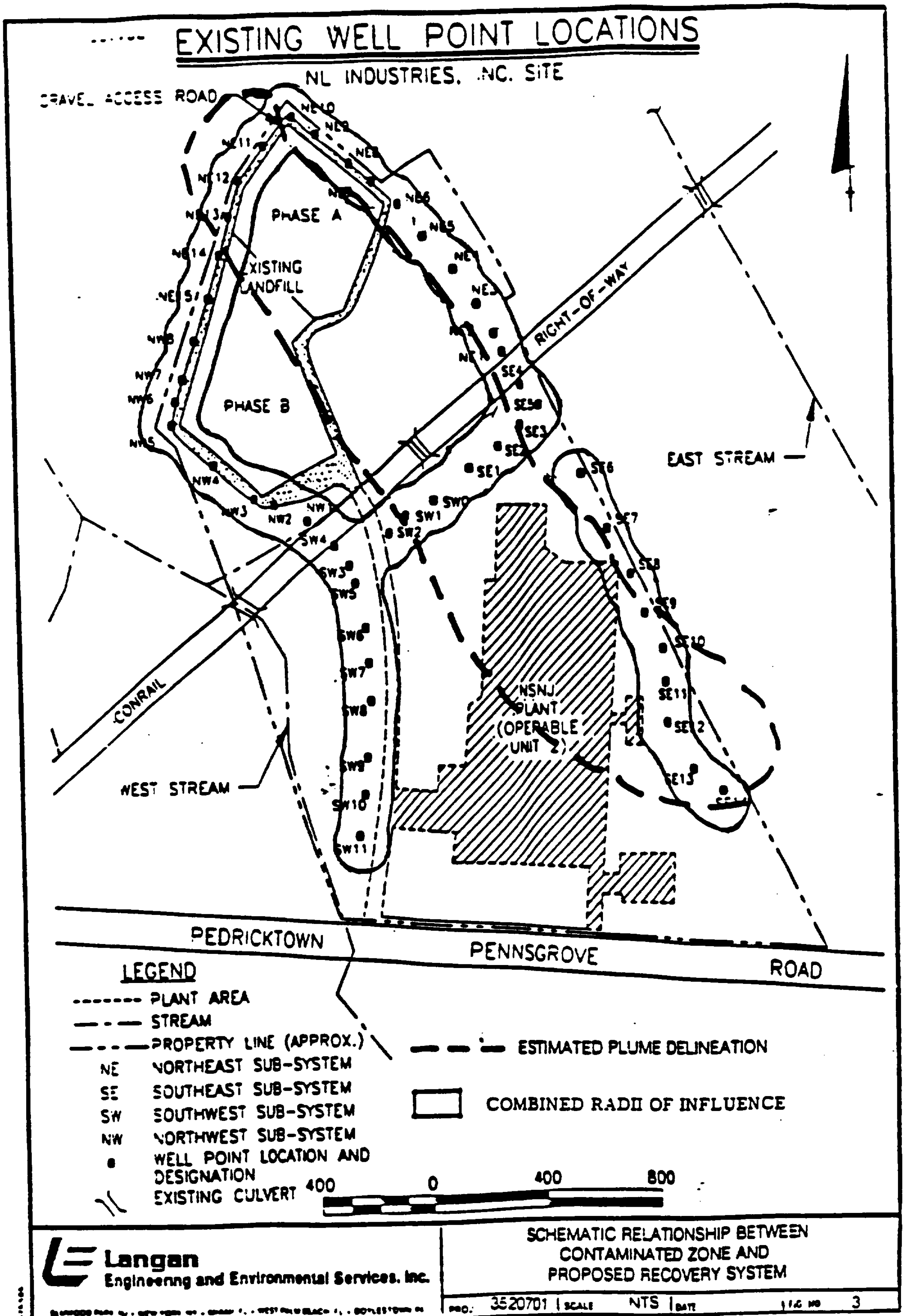
Because of dilution, it is not possible to estimate the influent concentrations, and of equal difficulty to design a treatment system of the proper capacity and operation specifications.

Efficiency of Proposed Recovery System Pedricktown OU-1: G.W. Remediation	BY TDG DATE 08-09-93 CKD ____ DATE ____	PROJ NO 3520701 SHEET 1 OF 2

Langan


EXISTING WELL POINT LOCATIONS
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Engineering and Environmental Services, Inc.
SCHEMATIC RELATIONSHIP BETWEEN CONTAMINATED ZONE AND PROPOSED RECOVERY SYSTEM
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NLI0022447

Janet D. Smith
Associate General Counsel

NL

September 17, 1993

BY HAND

Mr. Michael Gilbert, Project Manager
U.S. Environmental Protection Agency
Emergency & Remedial Response Division
26 Federal Plaza, Room 720
New York, New York 10278

Re: Comments on U.S. Environmental Protection Agency Proposed Plan for Operable Unit One, National Smelting of New Jersey/NL Industries, Inc. Site, Pedricktown, Salem County, New Jersey

Dear Mr. Gilbert:

This letter sets forth the comments of NL Industries, Inc. on the U.S. Environmental Protection Agency's July 1993 Proposed Plan for Operable Unit One of the National Smelting of New Jersey/NL Industries, Inc. Superfund Site, Pedricktown, Salem County, New Jersey (hereinafter, the "Pedricktown Site.") In summary, the comments address the following topics: (1) the inappropriate selection of 500 parts per million as the cleanup level for lead-in-soil at the site; (2) the premature and unwise decision to dredge stream sediments north of U.S. Route 130; (3) the erroneous choice of soil washing, an unproven technology, as the remedial alternative for soil; and (4) the exclusive selection of the on-site streams as the discharge point for treated groundwater, rather than considering both the streams and the Delaware River viable discharge options. For these reasons, the Proposed Plan is inconsistent with the National Contingency Plan ("NCP"), 40 C.F.R. Part 300, arbitrary, capricious and not in accordance with law, including the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C. §9601 et seq. We also submit comments on the Phase V removal action approved by the U.S. Environmental Protection Agency in conjunction with the Proposed Plan.

NL Industries, Inc.
Office of General Counsel
445 Park Avenue, New York, New York 10022 Tel. (212) 421-7204
Telecopier (212) 421-7207

I. There Is No Basis for the Selection of 500 Parts Per Million As the Cleanup Criterion for Lead-in-Soil

The Proposed Plan states that the cleanup criterion for lead-in-soil is based on the U.S. EPA's "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites"[1] ("Interim Guidance"), a U.S. EPA model that is used to evaluate potential lead exposure of children, and the Ecological Assessment performed for the Pedricktown Site. None of these supports the selection of the cleanup level set forth in the Proposed Plan. Further, a site-specific evaluation of lead exposures conducted as part of the baseline Risk Assessment performed for the Pedricktown Site indicates no adverse health effects from exposure to lead.

A. The Interim Guidance for Lead Cleanup Does Not Apply to the Pedricktown Site

The Interim Guidance recommends using a cleanup level for lead-in-soil in residential areas within the range of 500 to 1000 parts per million ("ppm"). This guidance is intended to protect human health in residential settings, but it focuses particularly on children, the most lead-sensitive portion of the population. Since the 500 to 1000 ppm cleanup range of the Interim Guidance is a recommendation for residential settings, it does not apply to the Pedricktown Site, an industrial property, where children are not found.

The Interim Guidance clearly specifies that a lead-in-soil cleanup range of 500 to 1000 ppm only applies "when the current or predicted land use is residential." The Pedricktown Site property is part of an area zoned for development as an industrial park. This area includes present and past operations of B.F. Goodrich, Airco, Browning-Ferris Industries, Exxon a cogeneration plant, and others. Given the industrial nature of the site and the zoning restrictions on its future use as anything other than industrial, it is inappropriate to conclude that the site will be either used for residential development or frequented by children. Therefore, the Interim Guidance cannot form the basis for a cleanup criterion for lead at the site, except to suggest that because of its industrial nature the site cleanup criterion for lead-in-soil should be above 1000 ppm.

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[1] The Interim Guidance is set forth in the U.S. Environmental Protection Agency's OSWER (Office of Solid Waste and Emergency Response) Directive #9355.4-02, September 7, 1989.

The implicit assumption of future residential use of the Pedricktown Site contained in EPA's application of the Interim Guidance to the site is inconsistent with recent testimony provided by EPA Deputy Administrator Robert Sussman at Congressional oversight hearings relating to the selection of remedies for Superfund sites. At the June 23, 1993 hearings, Mr. Sussman stated that EPA is now moving in the direction of assuming that the present land use will be the future land use unless there is persuasive information which is presented that shows current land use is likely to change.[2] Since the Pedricktown Site is zoned for industrial use and is surrounded by parcels similarly zoned and currently used for industrial purposes, continued industrial use should be assumed in carrying out a risk assessment. Consequently, site-specific considerations warrant the use of lead-in-soil cleanup levels above the higher end of the residential cleanup range of 1000 ppm.

B. EPA's Model of Childhood Lead Exposure Should Not Be Applied to an Industrial Site

In recent years, EPA has been developing and calibrating a model that predicts blood lead levels in children based on exposure to lead-contaminated media in lieu of its older, conventional risk assessment procedures for other pollutants. Since the model is intended to be applied to children in typical residential settings, it should not be applied to the Pedricktown Site. Moreover, the model is still under development and is being refined.

Nonetheless, available information on the model actually reinforces the conclusion that a lead-in-soil cleanup criterion for the Pedricktown Site based on risk considerations would be significantly higher than the 500 ppm selected in the Proposed Plan. EPA has circulated a memorandum[3] that states that if default assumptions are used with respect to lead exposures, a lead-in-soil cleanup criterion of 500 ppm would always be predicted by the model. These default assumptions represent exposure from regular contact and ingestion of lead, which is

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[2] See also Superfund Administrative Improvements, Final Report, June 23, 1993, at pp. 24-5.

[3] OSWER memorandum "Update on OSWER Soil Lead Cleanup Guidance" (Don Clay, U.S. Environmental Protection Agency, August 28, 1991).

substantially higher than the intermittent, low level exposure that might occur from occasional trespassing onto the Pedricktown Site by children. Therefore, lead cleanup criteria for the site would be significantly higher than 500 ppm, and should be above the Interim Guidance range of 500 to 1000 ppm recommended for in residential areas.

C. The Ecological Risk Assessment Does Not Support a 500 Ppm Lead Cleanup Criterion

The Proposed Plan provides that "EPA's site-specific Ecological Assessment concluded that 500 ppm of lead is the appropriate remedial action objective for site soils located in wetland areas, as well as stream sediments." However, a review of the Ecological Assessment indicates that several overly-conservative assumptions were used in the estimation of exposures for the target species, and, as acknowledged in the assessment, considerable uncertainty was associated with the literature-derived toxicological data applied in the assessment. As a consequence, by compounding inappropriate assumptions and uncertainties, the Ecological Assessment predicts that an unacceptable risk from exposure to lead exists at virtually any lead concentration in soil. This failure of a "reality check" significantly limits the use of the Ecological Assessment for developing a soil cleanup criterion. Thus, the 500 ppm lead cleanup criterion is arbitrarily selected and is not supported by the results of the Ecological Assessment.

During the development of the work plan for the Ecological Assessment and thereafter as it was carried out, NL Industries and its consultant ENVIRON provided extensive comments on the Ecological Assessment. A copy of the comments is attached hereto as Attachment 1. The following highlights the key criticisms of EPA's reliance upon the Ecological Assessment in risk management decisions at the Pedricktown Site:

- The Ecological Assessment does not establish a strong or consistent correlation between lead levels in soils and in earthworms and white-footed mice. Significantly, the field investigation failed to demonstrate that concentrations in earthworms decreased with decreasing exposure to lead. This failure severely limits the use of the dietary exposure-based risk assessment results to establish a lead-in-soil cleanup criterion at the site. Target species such as the woodcock whose risk supposedly derives from ingestion of earthworms may not be at risk at all if the level of lead in earthworms is not directly proportional to the level of lead-in-soil. This inadequacy of the field investigation, the foundation of the Ecological Assessment, largely invalidates its use as support for the lead-in-soil cleanup criterion selected in the Proposed Plan.

- In developing cleanup criteria that are proposed as maximum limit values, EPA has failed to consider that risks are derived from exposures of biota to mean soil levels within their home range. For example, if 500 ppm is established as a cleanup level for lead-in-soil (based on exposures of biota to soils that average 500 ppm), then once the site is remediated to a 500 ppm maximum residual level, then the actual exposures will be to soils in the species' home range that average less than 500 ppm. Thus, exposure should be recalculated taking into account the post-remedial reduction in the mean soil levels within a species' home range. This correction would make a major difference at the Pedricktown site, where the elevated concentrations requiring remediation constitute approximately 30 percent of the home range of the woodcock, one of the species to be protected by the proposed cleanup. Remediation of this area with the highest soil levels would significantly reduce the mean soil levels in the home range of the target species and therefore the mean exposure and risk would decrease significantly.

- If the hazard quotient "should be interpreted based on the severity of the effect reported and the magnitude of the calculated quotient," as the Ecological Assessment states, then even the effects on the woodcock, which have the highest hazard quotient estimates, would be further reduced because the toxicity endpoints (e.g., reductions in ALAD activity, hemoglobin and hematocrit, and in brain weight of nestlings) are not generally considered as severe as the ecological endpoints of survival, reproduction or growth.

- The use of scientifically justifiable alternative values for some of the exposure parameters (e.g., home range) and toxicity thresholds would reduce the hazard quotient estimates developed in the Ecological Assessment. For example, the available toxicity data indicate that a toxicity threshold of 8.25 mg/kg/day or higher is justified for the woodcock rather than the 4.1 mg/kg/day value that was applied. Thus, the Ecological Assessment proportionately overpredicts risks for the woodcock, and a cleanup criterion derived from consideration of risks to the woodcock would be proportionately too low.

D. The Risk Assessment for Lead Shows No Potential for Adverse Health Effects

A baseline Risk Assessment was conducted for the Pedricktown Site to evaluate the health effects associated with exposure to soils and ground water affected by the site. This Risk Assessment evaluated the future use of the site as industrial, and concluded that there would be no potential adverse health effects from exposure to lead in soils for a worker population. Therefore, EPA's proposed selection of the 500 ppm cleanup criterion is contrary to the results of the risk assessment, and has not been substantiated by any other quantitative characterization of risks at the site.

II. The EPA Proposal to Clean Up Sediments North of U.S. Route 130 Is Premature, Unwarranted and Could Have Severe Adverse Environmental Impacts

The Proposed Plan calls for remediation of stream segments located north of U.S. Route 130 ("Route 130"). However, commencement of this work is unwarranted by the present record, and ignores several important factors concerning these streams.[4] We recommend the adoption of Stream Alternative A for the sediments situated north of Route 130.

First, the water quality of the stream segments north of Route 130 should dramatically improve as a direct result of removal of the sources of the contamination. In particular, the Pedricktown Site Operable Unit Two surface cleanup of substantial sources of runoff from the Site, including the removal of lead-bearing slag, waste piles and pooled surface water, is now complete. This work has eliminated sources that contributed to the presence of lead in the waterways north of Route 130. Further, the anticipated removal of sediments south of Route 130, where significantly higher levels of lead are found in the sediments than are present to the north, should have an ameliorating effect on stream and river beds sediments north of Route 130. In addition, the ongoing flow and deposition of new sediments from upstream to downstream, from south to north, a process that is continual in the stream, will create a natural cap on top of the sediments north of Route 130.

[4] The comments summarized in this Section II. were submitted on NL's behalf by O'Brien & Gere to the U.S. EPA in July, 1992. See Attachment 2.

Second, the Proposed Plan fails to take into account the negative impacts of remedial action in the stream segments north of Route 130. These stream segments are too large to be diverted or dewatered, the techniques that can be used in the stream south of Route 130. The proposed excavation and dredging will be severely detrimental to the aquatic environment. Such dredging is likely to result in downstream transport of entrained, lead-bearing sediments and redistribution of contamination. Sediment resuspension and slump during the dredging might serve only to increase the concentration of lead in the water column. Dredging these stream sediments would be destructive to the existing ecosystem, increasing turbidity and decimating the benthic flora and fauna. This was made abundantly clear by the high mortality reflected in the results of the bioassay studies upon sediments from the stream conducted by Dr. Sprenger of the U.S. EPA as part of the field investigation of the Ecological Assessment. Such remediation should not be undertaken without first awaiting the outcome of the sediment cleanup south of Route 130, and allowing for the passage of time so that the newly cleaned sediments may form a cap. Thereafter, if monitoring demonstrates that stream sediments north of Route 130 contain levels of lead that are too high the decision to cleanup those sediments could be revisited.

Finally, while weighing the pros and cons of these invasive cleanup measures in the stream north of Route 130, the Agency should also consider that the sediments are affected by sources of lead not related to the Site. Elevated lead levels are found in two tributaries which discharge into the area north of Route 130 but do not receive runoff from the Site. These two tributaries were sampled by EPA (Samples EPA-1 and EPA-6.) Most likely, an upstream source affects these tributaries and is also contributing to water quality north of Route 130. In addition to the tributaries, runoff from the Army Corps of Engineers' dredge spoils piles will continue to enter the channels north of Route 130. The contribution of the tributaries and the dredge spoil disposal by the Army Corps may result in recontamination of sediments north of Route 130. Thus, any cleanup of sediments by dredging north of Route 130 could be physically destructive of habitat, and may be futile due to contribution by other sources.

For all these reasons, we believe that the correct remedial alternative for the stream sediments north of Route 130 is Sediment Alternative A. This alternative, which includes monitoring of stream water quality, would be most protective of the aquatic environment as it would allow time for the related cleanup activities to proceed, positively affecting the stream sediments north of Route 130. Further, this Alternative would not prematurely disturb the benthic ecosystem with destructive techniques that could be unnecessary, and in the long run, furnish no net environmental benefit.

III. Solidification/Stabilization Technology is A Superior Choice Because Soil Washing Technology is Unproven At Sites Comparable to Pedricktown, and Available Data Suggests That It Is Expensive and Will Fail at the Pedricktown Site

The Proposed Plan recommends modified Alternative Soil D as the remedial technology for contaminated soil at the Pedricktown Site. However, soil washing has not been fully implemented to date for remediation at lead battery or smelting sites, and available data suggests that it will fail at sites with soils that contain large portions of fine clays and high levels of humic material. In contrast, the soil treatment technology we recommend, solidification/stabilization, is a proven and widely used remedial technology for lead. It is also more cost-effective than soil washing, and does not result in the potential introduction of additional pollutants. Soil washing may even increase the volume of contaminants at the Pedricktown Site.

A. Overview of Soil Washing

Soil washing is a hybrid of remedial technologies. It may include the use of a washing solution, such as water, surfactants, chelating agents, or acidic solutions to achieve necessary particle size and separation and to extract contaminants from the soil. The washing solution and contaminated soil are mixed together, mechanically agitated and separated again. After this treatment, the soil is either returned to the site, treated further or disposed of offsite. The critical factor that determines the success of soil washing is whether it can extract sufficient lead to render the soil nonhazardous and reduce lead concentrations below applicable response objectives.

Under specific circumstances, soil washing has shown promise in the treatment of heavy metals, although not for lead. The technology works best on coarse-grained sandy soils, but is only marginally effective for remediating silty soils (more effective for treating a mix of sandy/silty soils then for a mix of silty/clay soils), and ineffective for fine clay soils.

Since soil washing is not a proven technology, its performance history at lead battery sites comparable to the

Pedricktown Site must be taken into account in determining its implementability for the Pedricktown Site. This performance history is reviewed in the next section.

B. Review of Soil Washing Experience and Literature Suggests That the Technology is Ill-Suited for Pedricktown

1. Selection of Control Technologies for Remediation of Lead Battery Recycling Sites, EPA/540/2-91/014, July 1991

This U.S. Environmental Protection Agency work reviews remedial options for lead contaminated soils including solidification/stabilization and soil washing/acid extraction. The document states that solidification/stabilization has been proven effective at full scale in remediating lead contaminated soils. The document further states that, while soil washing has been shown to be effective on a bench scale, it has not been successfully demonstrated at full scale. The Agency cites two full scale demonstrations, Lee's Farm in Woodville, Wisconsin and the Arcanum site in Troy, Ohio, where soil washing of lead contamination was attempted. In both cases, EDTA, a chelating agent, was used to promote the removal of lead from solution. Neither site was sufficiently cleaned up by the soil washing so soils at both sites required subsequent treatment by solidification/stabilization to complete the remediation. According to the paper, the majority of the problems with soil washing at these sites were related to materials handling. Clogging of filters by fine silty particles and excessive loading of suspended solids into the EDTA recovery system were nagging problems. These problems foreshadow what could be expected at sites with fine sandy soils or silty/clay soils, such as Pedricktown.

The paper also refers to the U.S. Bureau of Mines acid leaching process which used nitric acid and pretreatment to remove lead from soil. The Bureau of Mines has not yet completed their work or evaluated their process on a full scale. The paper concludes that soils which are high in clay, silt, and/or humic material are difficult to treat by soil washing, and that soil washing has not been effectively demonstrated on a full scale.

Review of this paper suggests that soil washing makes a poor choice for Pedricktown, in light of the soil composition, and leads to the conclusion that solidification/stabilization is a better, more reliable option.

2. Control Technologies for Remediation of Contaminated Soil and Waste Deposits at Superfund Lead Acid Battery Recycling Sites, Michael Boyer, et al., U.S. EPA, Edison, N.J. July 1992.

This U.S. Environmental Protection Agency paper states that full scale remediation using soil washing has not been successfully demonstrated even though bench scale studies have been favorable. The paper concludes that one of the chief limiting factors for soil washing performance is the physical nature of the soils, and that soils high in clay, silt or fines have proven difficult to treat. The paper also refers to the full scale soil washing failures at Lee's Farm in Woodville, Wisconsin, the ILCO site in Leeds, Alabama, and the U.S. Bureau of Mines bench scale studies.

The Bureau of Mines studies did indicate that high levels of lead removal can be achieved with acid washing. However, it is highly undesirable to introduce acid into the environment at a former lead smelter site such as Pedricktown. Moreover, the Bureau of Mines results have not been duplicated at full scale. The Bureau of Mines studies also indicated that soil washing with water and EDTA did not remove significant amounts of lead from any of the soil fractions.

Written a year after the July 1991 U.S. Environmental Protection Agency paper on soil washing, this later work does not hold out promise that soil washing has been improved into a remedial technology that will work well on lead-contaminated soils such as those at the Pedricktown Site.

3. Soils Washing, Bergmann USA/Applied Environmental Technologies Inc., Michael Mann and Jill Besch, August 1993

The organization performing this work is Applied Environmental Technologies Inc. (AET), an Dutch-American joint venture. We view the results reported as less reliable than those reported by the U.S. Environmental Protection Agency, since a company in the remedial technology business may be inclined to present a rosy picture of their abilities for marketing purposes. We include the results reported here for completeness.

The article reports that soil washing technology has been successfully employed by AET at five sites in the Netherlands. All of these projects were performed on coarse, sandy soils with initial soil concentrations in the range of 1,000 ppm lead.

According to AET, treatment efficiencies in the range of 80-90% have been demonstrated on these projects.[5]

AET has designed a soil washing remediation project in Winslow Township, New Jersey that is underway. This is the first full scale remediation of soils contaminated by heavy metals using soil washing in the United States. Soils at this site are primarily coarse sands. Contaminants of concern are chromium, copper, and nickel at concentrations of up to 500 ppm, 8,000 ppm, and 3,500 ppm respectively, but not lead. Initial data suggests treatment efficiencies are in the 80-85% range. AET claims that its process is effective in soils with less than 10% by weight of humic material and 400 mesh or larger soil particles, but warns that soils not meeting these criteria may not be amenable to soil washing.

Soils at the Pedricktown Site sharply contrast with the soils reported to be suitable for treatment by AET. Pedricktown soils contain fine sand, silt, clay and a large fraction of humic material, the type of material reported to clog treatment filters in the U.S. EPA reports. Moreover, Pedricktown Site soils have initial lead concentrations ranging up to 12,700 ppm, as opposed to the average of 1000 ppm reportedly treated by AET in the Netherlands. Thus, treatment by soil washing, even if it could be performed, is unlikely to produce treated soil meeting the 500 ppm lead remedial objective.

Treatment costs using the AET process are typically in the $150 to $250 per ton range depending on soil quantity and characteristics.

4. Soil Washing Test Performed on Pedricktown Site Soils by the Center for Hazardous Materials Research

The Center for Hazardous Materials Research reportedly subjected a sample of soils from the Pedricktown Site to soil washing and achieved lead concentration reduction from 30,000 ppm to "about" 1,000 ppm. The test conducted under laboratory conditions was unable to reduce levels of lead-in-soil below 1000

[5] We report upon what AET has presented, although we are unable to corroborate their work. On a cautionary note, it is difficult to extrapolate the results obtained in the Netherlands to what might occur in the U.S. due to differences in the regulatory environment.

ppm and therefore does not demonstrate that the designated treatment objective for the Pedricktown Site of 500 ppm lead can be achieved at full scale. Although we were not afforded the opportunity to observe this sampling or duplicate the results, we believe that it is likely that only soils from the coarse sandy fraction at the Pedricktown Site were subjected to the test, since otherwise the results would be inconsistent with the larger official studies reported above by the U.S. EPA.

C. Conclusions Derived From Review of U.S. EPA Reports Suggest That Soil Washing Will Fail at the Pedricktown Site

A review of available literature on soil washing shows that there have been numerous failures in applying soil washing at Superfund sites, and in laboratory efforts to develop the process. The literature does suggest that the technology may succeed when the soil to be treated possesses certain characteristics that make it more susceptible to washing, such as being coarse and sandy. Soil washing has not been demonstrated as effective at full scale in remediating lead contaminated soils in the United States.

While soil washing can be an effective remedial technology under ideal soil conditions, the feasibility of soil washing for the Pedricktown Site is highly questionable. Soils at Pedricktown contain fine sand, silt, clay and a considerable fraction of humic material. Such soils have been repeatedly shown to be difficult to treat with soil washing. Past attempts to treat such silts by soil washing have resulted in the occurrence of materials handling problems which resulted in the abandonment of soil washing as a remedial technology at full scale. Further, soils at the Pedricktown Site contain levels of lead as high as 12,700 ppm, lending a high degree of difficulty to the treatment process. It would be highly undesirable to complicate the environment at Pedricktown by the introduction of acids to promote better soil washing.

D. Soil Washing is Inferior to Solidification/Stabilization When the Statutory Criteria for the Selection of Remedies at Superfund Sites Are Applied

Application of the Superfund criteria for remedy selection to soil washing and solidification/stabilization results in inferior marks for soil washing when judged on implementability, cost, long and short term effectiveness and reduction in toxicity, mobility and volume. Soil washing has not been successfully implemented at full scale for remediation of lead contaminated soils at sites similar to the Pedricktown Site. To the contrary, sites that are comparable, such as Leed's Farm, Arcanum and ILCO resulted in large-scale remedial failures. Portions of these cleanups had to be completed using solidification/stabilization. Reports by the U.S. EPA in the literature strongly suggest that soil washing would fail at Pedricktown.

Since soil washing has not been successfully implemented at full scale for remediation of lead contaminated soils at lead battery sites, extensive treatability studies would be required to design a workable remedy. Parameters to be examined would be expected efficiency, type of washing solution, optimum contact time, and secondary waste generation quantities and characteristics. The particular characteristics and contaminant concentrations of the wastes, soil types and contaminant concentrations at the Pedricktown Site would have to be examined during these studies. Given the heterogenous nature of the Pedricktown soils and the relatively high concentrations of contaminants, extensive treatability studies would be required in the remedial design phase. As acknowledged by the U.S. EPA[6], there must be economies of scale involved in application of the soil washing technology in order to make it cost-effective. But since the quantity of soil that could be washed at Pedricktown is a relatively small amount, approximately 10,000 cubic yards, no economy of scale would exist, thereby rendering soil washing a remedy that scores low marks for both implementability and cost-effectiveness.

Even if soil washing were feasible, it would still be expensive. Unit costs for soil washing of heavy metals are typically $150 to $250 per ton for full scale remediations. Unit costs for solidification/stabilization are typically in the range of $100 per ton. A unit cost ratio of soil washing solidification/stabilization of 1.5/1 is typical for remediation. This ratio is actually somewhat higher for the Pedricktown Site according to the EPA figures in the Proposed Plan: the costs of Soil Alternatives D and F, as modified by the U.S. EPA, are projected as $10,712,000 and $6,450,000 respectively (a cost ratio of 1.65/1). Thus, soil washing, even if it were readily

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[6] "Guide to Conducting Treatability Studies Under CERCLA: Soil Washing", EPA/540/2-91/020A, September 1991.

implementable, would be far more expensive than solidification/stabilization at the Pedricktown Site.

If soil washing is unable to extract the lead to levels that meet response objectives, soil washing will be ineffective in reducing toxicity, and would in fact increase volume. And if the residual lead concentrations are not low enough for the soil to be used as replacement fill material, washed soil would be replaced in the on-site consolidation pile. Thus, the soil washing would have exacerbated conditions at the Pedricktown Site by increasing volume.[7] Moreover, the sludge and chemicals created in the soil washing process would also require disposal, thereby further increasing the total amount of material requiring treatment and disposal.

As to long-term and short-term effectiveness, soil washing trials at Lee's Farm and Arcanum site showed that soil washing technology is ineffective at lead battery sites. Past experience further demonstrates that soil washing has limited effectiveness at sites with fine silty or clay soils, or soils with appreciable quantities of organic matter. The ultimate success of soil washing does not lie in its ability to extract lead, but in removing enough lead to meet remedial objectives. Aqueous washes have been largely unsuccessful in this regard, with limited success experienced at the bench scale level using acid leaches. However, acid leaches have associated problems including proper worker training to handle acids, necessity for specialized acid-resistant equipment for the acid leaching process and the further treatment of lead sulfate sludge that is produced. In general, the historical lack of demonstrated effectiveness of soil washing at lead sites casts grave doubt upon its ability to meet remedial objectives at the Pedricktown Site.

IV. The Agency Should Retain Two Options for Groundwater Discharge Rather than Selecting Only the Stream Discharge Point

NL Industries has studied the September 15, 1993 "Review and Comments on Groundwater Investigation and Remediation Strategies"

[7] While there may be some small benefit from the reduction in mobility of the washed soil disposed in the consolidation pile, given that the pile must be lined and capped anyway and the material has inherently low solubility, the mobility of the lead is low even without treatment. Thus, the incremental benefit from soil washing is marginal at best.

prepared by Langan Engineering and Environmental Services, Inc., submitted to the U.S. EPA as commentary on the Proposed Plan. NL joins in the comments to the extent that they endorse further groundwater monitoring and the re-examination of the need for groundwater remediation.

If and when the EPA determines to proceed with groundwater remediation as set forth in the Proposed Plan, NL believes that the Agency should preserve two options for the discharge of treated groundwater. The Proposed Plan recommends the discharge of treated groundwater to the East or West Streams rather than to the Delaware River. This selection is premised on the assumption that a Delaware River discharge might be delayed or blocked by the need for the construction of a pipeline crossing the railroad tracks, Route 130 and several private properties, and would require a NJPDES permit. We believe that these logistical issues could be readily resolved, and would not delay the groundwater cleanup. NL recommends that the Proposed Plan be modified to preserve Groundwater Alternatives G-1 and G-2 inasmuch as Alternative G-2 may be more implementable and cost effective, but the alternatives are otherwise comparable. We recommend that the final choice of discharge point be made during the remedial design phase.

A. Logistics and Access

There is sufficient space on the Pedricktown Site north of the railroad right-of-way and south of the existing landfill to accommodate a treatment plant of the type and size anticipated for treating groundwater at the site. In fact, the existing well point system piping network extends under the railbed to this location. Thus, a treatment plant could be sited north of the railroad right-of-way, close to the Delaware. The outfall could be constructed under Route 130, since the jacking of water pipelines under major highways is routine construction practice. The requisite permit from the New Jersey Department of Transportation should be readily obtained.

NL has commenced the process of exploring whether access agreements may be obtained to construct a pipeline across the private properties situated between the north side of the Pedricktown Site and the Delaware River. Both B.F. Goodrich[8] and

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[8] B.F. Goodrich has already demonstrated the feasibility of such a pipeline in that it currently runs a discharge pipeline from its facility to the Delaware River.

Corrosion Control have favorably responded to NL's overtures. A copy of correspondence to these companies is attached as Attachment 3. Based on discussions with these companies, we believe that access for a pipeline easement could be obtained in a timely fashion and would not delay construction of the outfall.

B. Water Discharge Permit Requirements

Constructing a treatment plant and outfall as proposed in Groundwater Alternative G-2 would require water discharge permits, a New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water permit and a Treatment Works Approval. The NJPDES permit is required prior to discharging treated groundwater to the Delaware River. The permit would specify flow and effluent limitations for contaminants. Our review of Recommended Water Quality Criteria for Toxic Pollutants for the Delaware River Estuary (January 1992), confirmed by representatives of the Delaware River Basin Commission, indicates that lead discharge levels for the proposed treatment plant could be up to 63 parts per billion and be protective of the aquatic environment for the Delaware River Basin's Region V.[9] This remedial objective should be more implementable and cost effective than a discharge to the East or West Stream, where lead would have to be treated to 10 parts per billion or less. We do not anticipate any delay in obtaining a NJPDES permit, since it must be issued six months after the receipt of a complete application.

Several other permits may be required for the Delaware discharge option, and they should be readily obtained. A Treatment Works Approval ("TWA") would be required for the construction of the groundwater treatment plant and outfall. The State of New Jersey is required by law to review and approve a TWA application within 90 days. Additional permits which may be needed (depending on the exact placement of the discharge outfall) include a wetlands permit, a Coastal Area Facility Review Act permit and a stream encroachment permit. All of these permits must be issued within ninety days after receipt of a complete application.

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[9] Upstream of any discharge from the Pedricktown site, the Delaware River receives effluent of 500 mgd from the City of Philadelphia wastewater treatment plant as well as several other significant municipal and industrial discharges. The volume of flow in the River is sufficient to accept these discharges with no degradation.

The total time for obtaining permits is approximately twelve months, allowing adequate time for completion of the permit applications. Since design of the groundwater treatment system, including treatability studies, should take twelve months, and construction should take twelve to eighteen months, the time needed to secure the necessary permits would not delay the commencement of treatment, since it can occur at the same time as design and construction of the treatment works. Accordingly, the discharge of treated groundwater to the Delaware River is as feasible as a discharge to the East or West Streams in terms of time, permitting and access.

C. Because Alternative G-2 Might Provide a Substantial Cost Savings Over G-1, It Would Be Preferable to Retain Both Discharge Options

Anticipated costs for Groundwater Alternative G-1 are approximately $1.5 million more than Alternative G-2. These additional costs are primarily attributable to the costs associated with the reverse osmosis required to meet water quality standards in the streams. Thus, G-2 may be both more implementable and less expensive. Since Alternatives G-1 and G-2 are otherwise roughly comparable in meeting environmental objectives, NL recommends retaining both discharge options, and making the final decision during the remedial design phase.

V. The Phase V Removal Action is a Public Works Project Not an Environmental Response Action

The U.S. EPA approved the Phase V removal action for the Pedricktown Site on July 15, 1993, in conjunction with the Proposed Plan for Operable Unit One. The Removal Action Memorandum requested a ceiling increase of $1,237,700. The Phase V Removal Action is: (1) inconsistent with the NCP, (2) inconsistent with the proposed long term remedial action, and (3) predicated upon a Salem County flood control project rather than an imminent and substantial endangerment to human health, welfare, or the environment.

A. The Phase V Removal Is Inconsistent With The NCP

CERCLA establishes criteria for responding to a release into the environment of any pollutant or contaminant that may present an imminent and substantial danger to the public health and welfare. The criteria include the following:

1. "Removal actions shall, to the extent practical, contribute to the efficient performance of any anticipated long term remedial action with respect to the release concerned." NCP §300.415(c).

At the Pedricktown Site, all upgradient sources of the contaminant of concern (lead) have not been removed. Surface soils, immediately upgradient of the West Stream, contain lead in excess of 9,000 ppm. These soils are scheduled for remedial action pursuant to the proposed plan for Operable Unit One 1. The excavation of the stream to a depth of four feet may enhance erosion of the upgradient surface soils, resulting in the recontamination of the stream sediments. Accordingly, this removal action is inconsistent with the proposed remedial action. Moreover, the environmental remediation of the East Stream should be carried out at the same time as the West Stream to avoid the inherent waste in remobilization.

2. "Fund financed removal actions, other then those authorized under section 104(b) of CERCLA, shall be terminated after $2 million has been obligated for the action or 12 months have elapsed from the date that removal activities begin onsite .... " NCP §300.415 (b)(5).

Funding for Phase I of the Removal Action was approved in 1988. The Phase I Removal Action was completed on May 31, 1989, and the Phase IV Removal Action was completed on June 26, 1992. Accordingly, more than four years have elapsed from the date that removal activities began on site, and more than twelve months since Phase IV was completed. Thus, the Phase V removal contravenes CERCLA and the NCP.

3. "Whenever a planning period of at least six months exists before on-site activities must be instituted ... [t]he lead agency shall conduct an engineering evaluation/cost analysis ("EE/CA") or its equivalent" NCP §300.415 (b)(4), and shall "[p]ublish a notice of availability and brief description of the EE/CA in a major local newspaper of general circulation ... [and] [p]rovide a reasonable opportunity, not less than 30 calendar days for submission of written and oral comments .... " NCP §300.415(m)(4).

The Agency has had full knowledge of the contaminants of concern in the West Stream sediments prior to the approval of the Remedial Investigation Report on July 8, 1991, providing more then ample time for completion of the EE/CA. There has been no notice of availability or brief description of the EE/CA published to date, or opportunity provided for submission of comments pursuant to the above.

4. "Where the responsible parties are known, an effort initially shall be made, to the extent practicable, to determine whether they can and will perform the necessary removal action promptly and properly." NCP §300.415(a)(2).

The Agency has known the identity and location of numerous potentially responsible parties prior to the Phase I Removal Action of 1989, and has not notified any of these parties regarding any phase of the removal actions.

B. <u>The Phase V Removal Action Is A Thinly Disguised Public Works Project</u>

In January 1992, the Salem County Mosquito Control Commission ("SCMCC") commenced excavation of sediments from the West Stream, immediately south of Route 130, depositing those sediments along the northeast bank of the stream. This action was performed to alleviate flooding in upstream farm lands. Due to the distribution of contaminated sediments along the banks of the stream, subjecting the area soils to potential contamination, the EPA required the SCMCC to cease disturbing the contaminated stream sediments. Forced to change course, the SCMCC installed drainage ditches along the north sides of Pennsville-Pedricktown Road and New Road as an alternative measure to reduce the flood potential.

The risk of flooding and sediment redistribution has been greatly diminished by these SCMCC flood control measures. Meanwhile, the EPA performed removal action at the site, and a Focused Feasibility Study which culminated in the performance of Operable Unit Two at the site. Throughout the past year, additional upgradient sources of lead have been removed from the site under Operable Unit Two, further reducing the potential spread of contaminants. Accordingly, the potential risk or threat to health and the environment has been controlled by focusing on both the risks of flooding and of runoff from surface contaminants. Nonetheless, the EPA has chosen to proceed with another phase of its four-year old removal action.

While the U.S. EPA will be removing only the first foot of sediment from the stream, the Agency is voluntarily donating resources to the SCMCC "stream enhancement" program by excavating to a fourteen foot width in a stream having a present maximum width of approximately five to six feet. The stream widening is dictated only by the SCMCC program, not by any stated environmental concerns. After the U.S. EPA work, the SCMCC will deepen the stream by an additional three feet. The SCMCC, and not the EPA, will be determining stream sediment removal areas by "staking the new route of the widened stream." This demonstrates that the EPA is not determining the specific removal areas based upon any environmental criteria, but is responding to the local flooding fears using federal funds earmarked for Superfund cleanups.

VI. Conclusion

In conclusion, NL believes that there is no basis for the choice of 500 parts per million as the cleanup level for lead-in-soil at the site. Considering the industrial land use of the site, the cleanup level for soils should be greater than 1000 ppm. In addition, the experience of the EPA and other companies with soil washing, an unproven technology with respect to lead cleanups, clearly demonstrates that it is the wrong choice for the remedial alternative for soil at the Pedricktown site. Solidification/stabilization is more cost effective and has proven to be a more reliable and feasible technology at lead sites and should be selected as the preferred alternative. Taking into account the potential adverse impacts of dredging in a water column, NL recommends proceeding with a conservative monitoring program before invading the streambed north of Route 130 with dredging equipment. Similarly, NL joins in the comments of Langan Engineering and Environmental Services, Inc. as to the uncertainty of the need for groundwater remediation at this time, and recommends that when and if groundwater remediation is conducted, the Agency should consider both the streams and the Delaware River viable discharge options. Finally, we believe that the Phase V removal action is unwarranted and motivated by local desires for flood control assistance rather than environmental protection.

Respectfully submitted,

Janet D. Smith

Janet D. Smith

cc: Susan H.S. Monks, Esq.

ENVIRON

July 6, 1993

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C.K. PAL

Chief, Site Investigations and
Compliance Branch
Emergency and Remedial Response
Division - Room 720
U.S. Environmental Protection Agency
26 Federal Plaza
New York, NY 10278

Attention: Michael Gilbert, Project Officer

Re: NSNJ Pedricktown, New Jersey Facility RI/FS

Dear Mr. Gilbert:

We were pleased to receive draft copies of the January *Final Report: Field Ecological Assessment* and the *Ecological Risk Assessment* for the Pedricktown, New Jersey Superfund Site, and to have the opportunity to discuss, on behalf of NL Industries, our initial comments on the drafts with you, Dr. Mark Sprenger and Ms. Kim O'Connell at your offices on March 9, 1993. At the request of NL Industries, ENVIRON prepared the attached report summarizing the comments made at the meeting as well as a few additional comments that were developed following a more thorough review of the documents.

We trust that the comments will be of assistance to you in preparing the final reports. If you have any questions, please contact me at (703) 516-2300.

Very truly yours,

DMWoltering

Dan Woltering, Ph.D.
Principal

cc: Paul Harvey, NJDEPE (Three copies)
Dr. Mark Sprenger, U.S. EPA
Evans Stamataky, U.S. EPA
Steve Holt, NL Industries, Inc.

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COMMENTS ON THE USEPA ECOLOGICAL RISK ASSESSMENT FOR THE NL PEDRICKTOWN SITE

In January, 1993 U.S. Environmental Protection Agency (USEPA), Region II (Environmental Response Branch, Emergency Response Division, Office of Emergency and Remedial Response) released two draft documents concerning the assessment of ecological risk associated with lead contamination at the NL Industries, Inc. (NL) Site, Pedricktown, New Jersey. The first document, *Final Report: Field Ecological Assessment*, describes a series of field investigations to collect empirical data on target receptors and surrogate organisms to be used in a subsequent ecological risk assessment of lead contamination in the vicinity of the NL Site. The report presents data on sediment toxicity, aquatic vertebrate lead levels, earthworm *in-situ* bioaccumulation of lead, small mammal lead contamination, and a terrestrial and wetland habitat assessment. The second document, *Ecological Risk Assessment*, uses the data presented in the *Field Ecological Assessment* to assess the risk of lead contamination at the NL Site to the following species of concern: woodcock, robin, great blue heron, red-tailed hawk, long-eared owl, red fox, and mink. Of the seven indicator species considered by the USEPA, four species, woodcock, robin, red fox, and mink were concluded to be at risk from lead at all areas assessed.

The purpose of this document is to provide technical comments on the USEPA *Field Ecological Assessment* and *Ecological Risk Assessment* reports. Four areas are covered:

- Field investigation results: soil lead levels;
- Use of field results in the assessment of ecological risk: earthworm and white-footed mouse lead levels;
- Toxicity thresholds and exposure parameters used in assessing the risk of lead contamination; and
- Computational errors in the *Ecological Risk Assessment*.

I. Field Investigation Results: Soil Lead Levels

The XRF data used to determine the soil lead concentrations in the areas selected for assessing biota lead contamination are of questionable value in a quantitative assessment of exposures. XRF soil analysis significantly overestimates the lead concentrations, which, in turn, results in an overestimation of the exposure estimates for indicator species.

The *Ecological Risk Assessment* uses XRF analysis data for surface soil lead as an input into the overall oral exposure level for indicator species. This surface soil lead data is directly incorporated into the oral dose calculation through the use of an incidental soil ingestion rate. The use of the XRF data grossly overestimates the oral exposure via this route. Figure 1 illustrates the relationship between XRF-determined lead concentrations and lead concentrations measured by atomic absorption spectroscopy (AA) for the same soil samples. It is evident that the XRF results overestimate the lead concentration in soil by a factor as high as 8X. Figure 2 groups XRF data into discrete lead concentration ranges and shows that the ratio of XRF to AA ratio is at least 2. It therefore follows that indicator species' oral exposure levels from incidental soil ingestion should be reduced by a factor of at least 2.

II. The Use of the Field Results in the Assessment of Ecological Risk: Earthworm and White-Footed Mouse Lead Levels

A. Earthworm Lead Levels

1. There is no apparent relationship between the lead concentrations in the test chamber soils and those in earthworms.

The *Final Report: Field Ecological Assessment* describes an *in situ* earthworm bioaccumulation study. *Eisenia foetida* were used to test for bioaccumulation of lead over a 28-day period at twenty locations that were selected to represent a range of target soil concentrations of lead. A sample of worms from the stock culture served as a time zero lead concentration. However, no background (i.e., off-site local soil) worm bioaccumulation control was included in the test. After 28 days of exposure, the earthworms were removed from the test chambers, depurated of gut contents, and analyzed for lead.

Earthworms exposed to lead contaminated soil for 28 days accumulated lead to levels ranging from 29 mg/kg to 170 mg/kg. Lead concentrations of earthworms (dry weight) were not correlated with soil lead levels in the *in situ* test chambers ($r=0.18$, $n=20$). Similarly, lead concentrations in earthworms were not correlated with other soil parameters measured: TOC, grain size, pH, and percent organic matter.

A plot of earthworm lead concentrations expressed as wet weight versus soil lead concentrations (Figure 3) also supports the conclusion that there is no discernable relationship. The figure illustrates that earthworm lead concentrations do not appear to increase with soil lead concentration. Furthermore, the concentrations of lead in worms associated with the

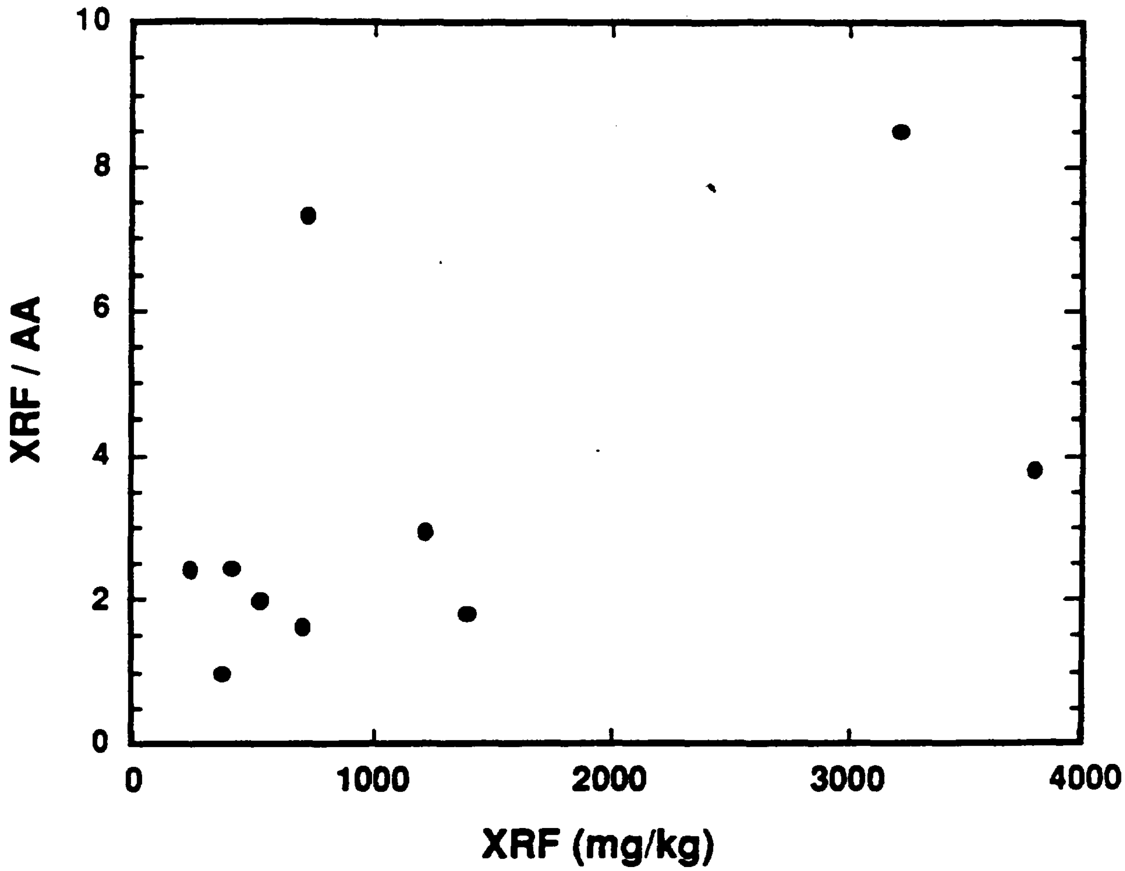

Figure 1. Relationship Between XRF and AA Measurements in Soils Less Than 4,000 ppm

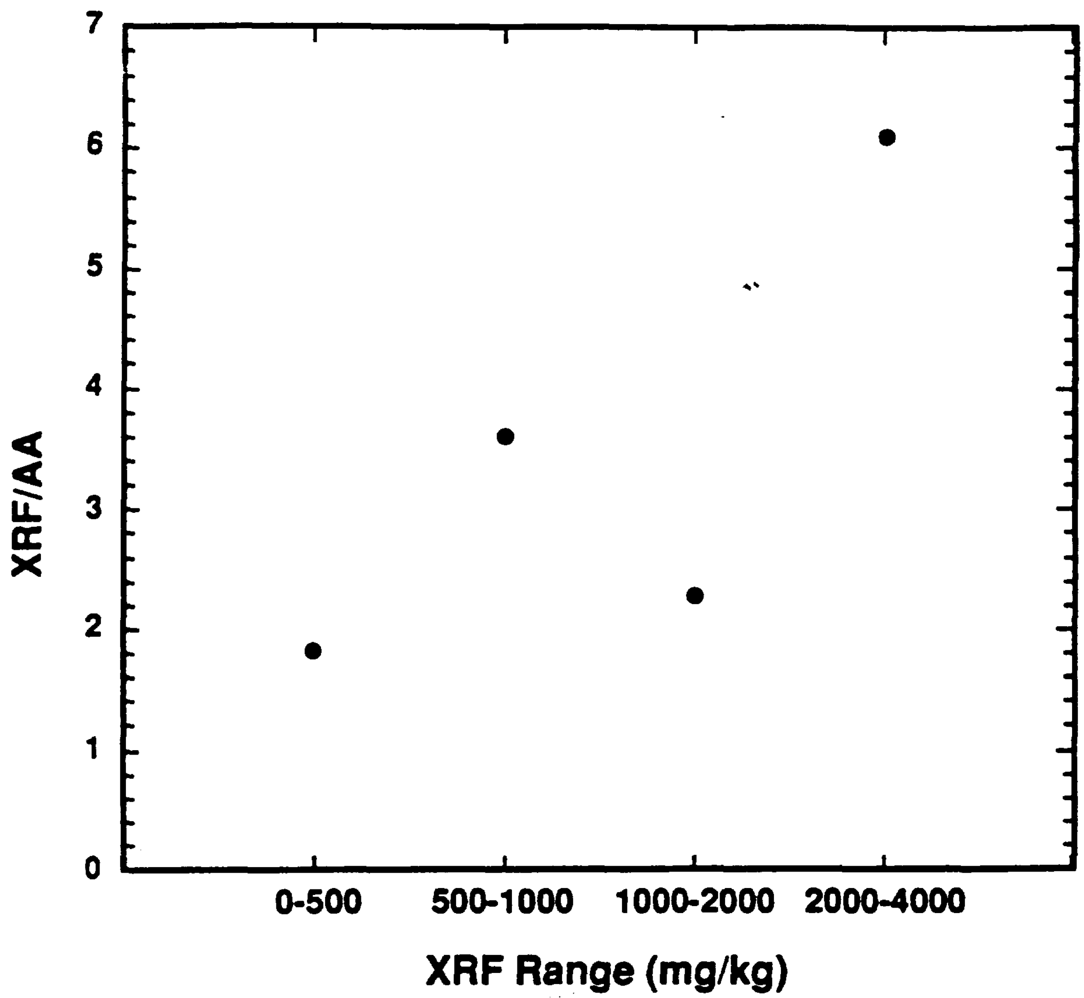

Figure 2. Ratio of XRF to AA in Soils

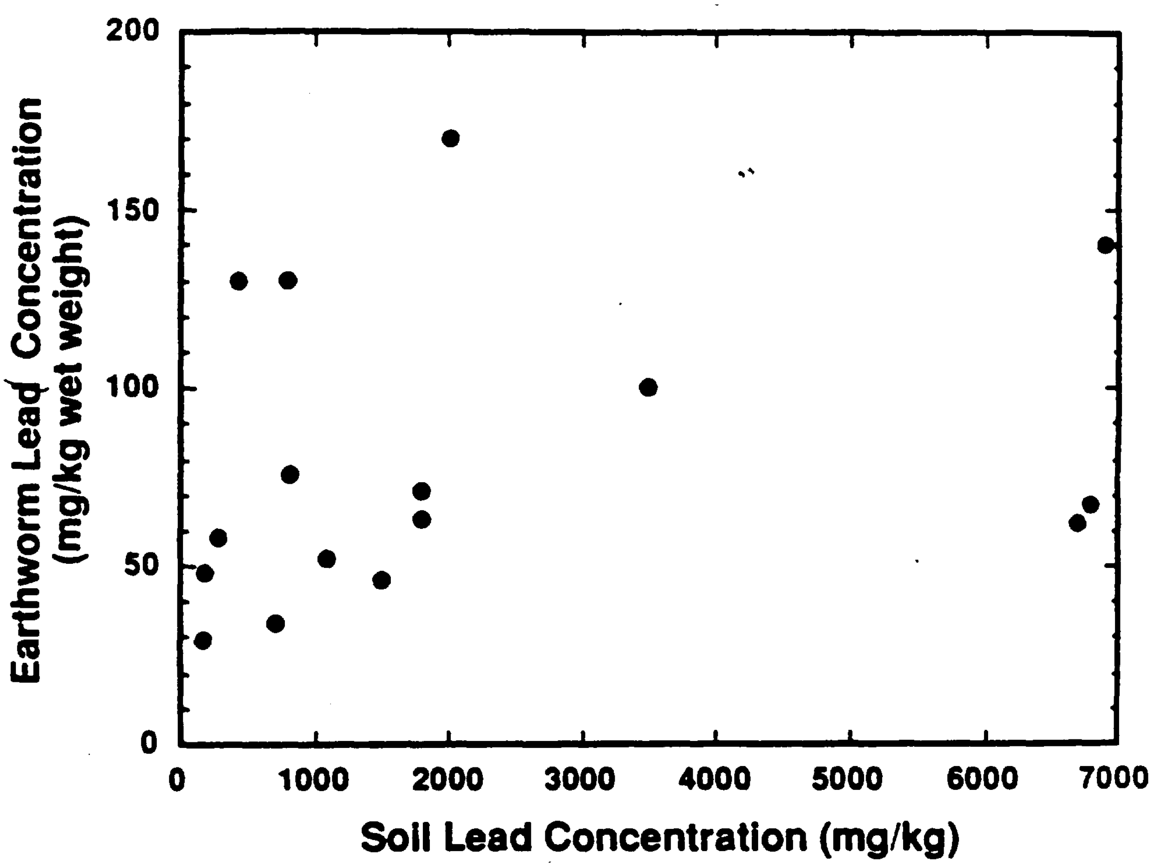

Figure 3. Earthworm Lead Concentrations Versus Soil Lead Concentrations

contaminated areas cannot be evaluated against background worm lead concentrations due to the lack of a background control in this experiment.

2. **USEPA's division of the observations into groups as <500, 500-1,000, and >1,000 mg/kg soil is arbitrary, and the pattern of the group mean earthworm concentrations is dependent on this division.**

The *Ecological Risk Assessment* arbitrarily groups the results of the earthworm accumulation study into three ranges of soil lead levels, <500 mg/kg, 500-1,000 mg/kg, and >1,000 mg/kg with associated mean earthworm lead levels of 66.3, 80.0, and 85.7 mg/kg (wet weight), respectively. This suggests some correlation between lead in soil and lead in earthworms, although the *Ecological Assessment* states that no statistical correlation exists between lead in earthworms and lead in soil. In addition, this grouping results in an uneven distribution of observations (only four are <500, three between 500 and 1,000, and nine are >1,000).

An alternative grouping of earthworm data by soil lead levels to maintain more equal group distribution would be <1,000 (seven observations), 1,000-2,000 (four observations), and >2,000 (five observations). Figure 4 shows that placing the earthworm observations into a different grouping of lead concentrations results suggests that no correlation exists between earthworm lead and soil lead.

B. White-Footed Mouse Lead Levels

1. **There are no significant differences among the mean lead concentrations in mice (dry weight) collected from the various grid areas.**

The *Final Report: Field Ecological Assessment* describes a small mammal tissue lead study. Small mammal trapping was conducted in three discrete wooded areas of the site identified during a preliminary site visit. A target sample size for each wooded area consisted of 10 white-footed mice (*Peromyscus leucopus*). The contents of the gastrointestinal tract of each animal was removed and the whole body was analyzed for lead. XRF screening for soil lead concentrations was conducted for each area sampled for small mammals.

Page 29 of the *Final Report: Field Ecological Assessment* states that there are no significant differences among the mean lead concentrations in mice form the different sampling grids, when expressed on a dry weight basis.

2. **The pattern of differences in the mean wet weight lead concentration in mice is not consistent with the apparent pattern of differences in mean**

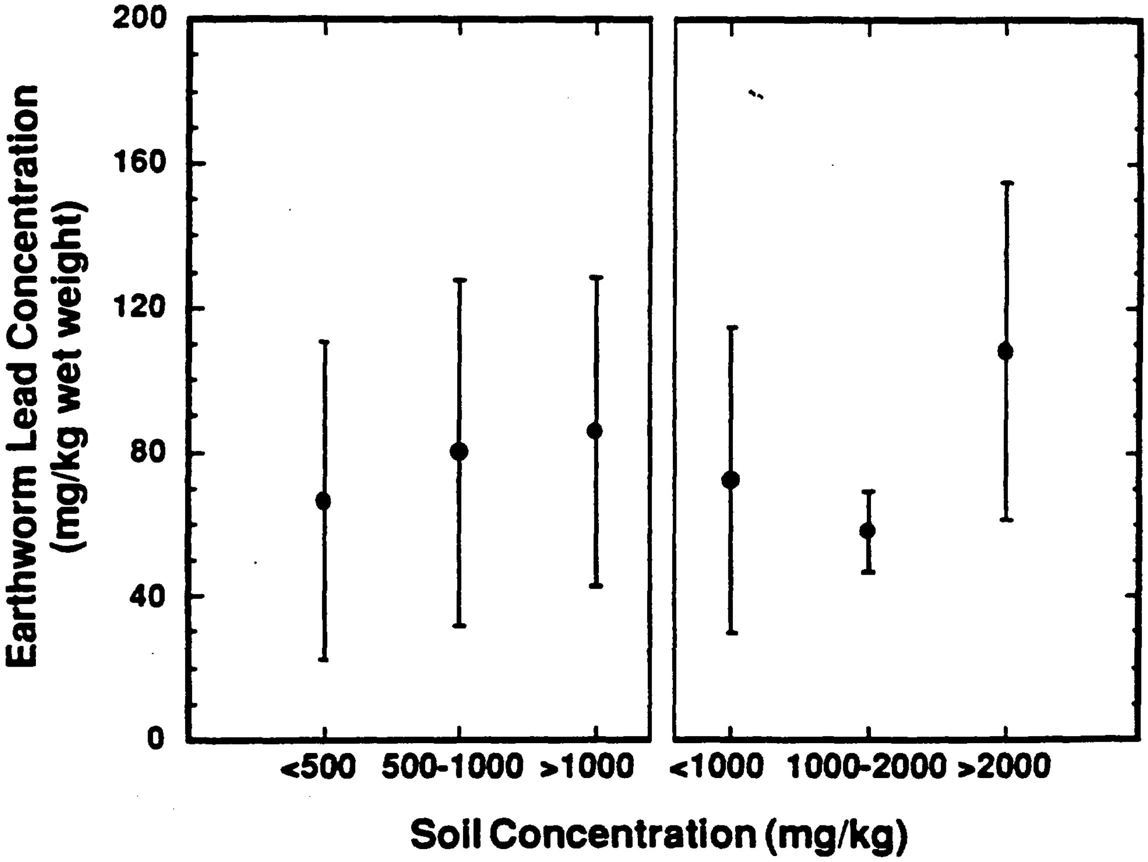

Figure 4. Influence of Selection of Soil Concentration Intervals on Calculated Mean Earthworm Concentration

soil lead concentration among the areas. Figure 5 presents a side-by-side comparison of a plot of mean lead concentration in mice (wet weight) vs. mean soil lead concentration to a plot of the means and standard deviation bars for soil lead concentration data in each sampling area. Soil lead levels are lowest in Area II and highest in Area III. The mean concentration in mice on a wet weight basis is lowest in Areas I and IA. This inconsistency suggests that the lead concentrations of the mice are not strongly related to the lead concentrations in the soil.

III. Toxicological and Biological Assumptions Used in the Ecological Risk Assessment

The area use factor is incorrectly applied in the ecological risk assessment. As described in the assessment (Page 6), "The area use factor is defined as one if the study area is greater than the home range of a species. If the study area is less than the home range, a ratio of home range size to the size of the study area will be used." The study area for the assessment is 200 acres. This application of the area use factor fails to consider the levels of lead existing within the "study area", so that the entire 200 acres is assumed to be contaminated at average lead levels between 1000 mg/kg and 2300 mg/kg depending on the exposure scenario being evaluated. This approach applies elevated lead concentrations to uncontaminated areas and areas of low concentration within the 200 acre "study area", thereby significantly overstating the ecological risk to the receptor/indicator species.

A. Woodcock Assumptions

The available data suggest a toxicity threshold of 8.25 mg/kg/day and a home range of 108 acres for the woodcock.

1. The USEPA toxicity threshold is based upon a field study of lead levels in European starlings (Grue et al. 1986) which showed reductions in hematocrit, red blood cell ALAD activity, and brain weight ***of nestlings*** in a population estimated by USEPA to be exposed to dietary lead at approximately 4.1 mg/kg/day. Since these data were not included in the work plan commented on by ENVIRON (*Comments on Proposed Toxicity Thresholds and Exposure Parameters for the NL Pedricktown Site Ecological Risk Assessment*, submitted by NL Industries, Inc. on November 19, 1992) a review of the study and USEPA's interpretation was conducted.

   Grue et al. (1986) is a field study of lead contamination of soil, invertebrates, and tissues of European starlings nesting in areas of high vehicular traffic. The study includes measures of blood ALAD activity, hemoglobin concentrations, hematocrits, body weights, brain weights, clutch size, hatching success, and fledgling success for the starling populations. Adult birds from areas where ingesta contained lead at 84 mg/kg dry weight

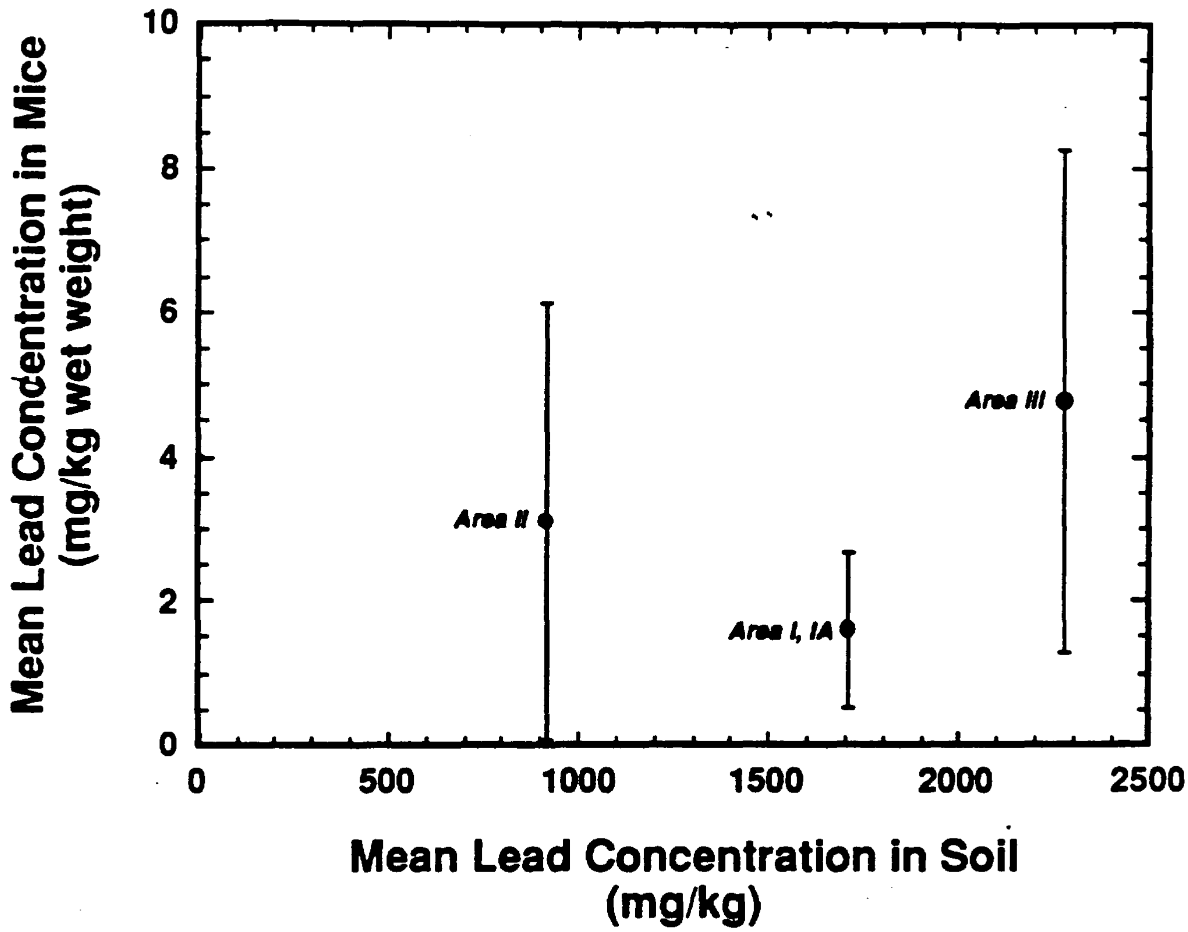

Figure 5. Plots of Mouse Lead Versus Mean Soil Lead and Mean Soil Lead by Area

exhibited ALAD activity depressions of 43 to 60 percent when compared to control populations. However, these adults showed no weight loss, paralysis, or loss of vision, nor were any reproductive effects noted. Nestlings from areas where ingesta contained lead at 94 mg/kg dry weight exhibited a 16 percent reduction in hemoglobin concentration, a 10 percent reduction in hematocrit, and significantly lower brain weights when compared to controls. It is not clear that any of these reductions would produce ecologically significant effects. Reduced brain weight in nestlings appears to be the most sensitive/serious endpoint. USEPA interprets this study as showing adverse effects in starlings at a concentration of lead in ingesta (wet weight) of 13.3 mg/kg. Because the ingesta lead concentrations in the study are reported on a dry weight basis, and no water content data for the ingesta samples are reported, it is unclear how the 13.3 mg/kg wet weight value was obtained.

Further, USEPA derives its dietary effects threshold using adult food consumption and adult body weight data even though adverse effects were reported not for adults but for nestlings. In order to accurately reflect the fact that the more ecologically significant adverse effects were observed in nestlings, a daily dietary effect threshold should be based upon food consumption and body weights for nestling starlings. Grue et al. report a starling nestling weight of 66.9 g as compared to the USEPA adult weight of 75 g. The ingestion rate for adult starlings reported by USEPA is 31 percent of body weight per day. A relationship between juvenile and adult bird consumption rates can be assumed to be such that juveniles consume twice the food per unit body weight as adults (e.g. juvenile chickens consume food at a rate of 13 percent of body weight/day, while adult chickens consume 6 percent of body weight/day [Fraser and Mayes 1986]). On the basis of this relationship, the juvenile starling food consumption rate would be 62 percent of the body weight per day, or 41.5 g/day. Allowing for the validity of the 13.3 mg/kg wet weight ingesta threshold for adverse effects in nestling starlings, the daily dietary threshold for nestling starlings would be 8.25 mg/kg/day (13.3 mg/kg X 0.0415 kg/day X 1/0.0669 kg bw = 8.25 mg/kg/day) instead of the 4.1 mg/kg/day assumed by USEPA.

2. The *Ecological Risk Assessment* lists the home range of a woodcock as being 45 acres, citing the work of Wilson (1982). This home range size does not accurately reflect the data in Wilson (1982) which lists the average home range to be 44 ha (not 45 acres) or equivalent to 108 acres.

B. Robin Assumptions

The alternative toxicity threshold value of 8.25 mg/kg/day discussed above also applies to the robin.

C. Red Fox Assumptions

The available data suggest a toxicity threshold of 2.5 mg/kg/day, and a territory size of 698 ha. for the red fox.

1. In the *Ecological Risk Assessment*, USEPA cites Demayo et al. (1982) as the source for the toxicity threshold for dogs (surrogate for the red fox) of 0.32 mg/kg/day. Demayo et al. (1982) is a secondary source that cites Hatch (1977) as the source of the 0.32 mg/kg/day. Hatch (1977) is also a secondary source that cites Zook (1973) as the source of the 0.32 mg/kg/day. Zook (1973) is also a secondary source that cites the original source of the 0.32 mg/kg/day (Finner and Calvery 1939). The Finner and Calvery study involved the feeding of lead to only 29 dogs. Of the 29 dogs used in the study, only data for five dogs are reported. Data for the other 24 animals is not available. Of the subjects reported, three received an estimated dietary dose of lead (as lead acetate) of 1.5 mg/kg/day. One of these dogs died at day 43 of exposure,a second died following 121 days of exposure (interrupted by an interim period for treatment for convulsions), and the third dog suffered paralysis by day 14 yet survived until sacrifice (time of sacrifice unreported, but over 228 days after initial exposure). The two other dogs reported were exposed to an estimated 0.33 mg/kg/day lead in the diet. These two dogs died after 140 and 167 days of exposure, with no interim signs of intoxication. No data on food consumption for the five reported subjects is available, thus the dietary dose estimates cannot be confirmed. In addition, the absence of data on the other 24 dogs in this study prevents validation of the authors' statement that the five cases reported were typical of results for all dogs. This study is not well designed nor are the results documented sufficiently to form the basis of a toxicity threshold.

   The 0.32 mg/kg/day toxicity endpoint adopted by USEPA is almost an order of magnitude below the endpoints reported for the 1973 multi-dose, multi-subject, controlled dog study deemed acceptable for inclusion in the ATSDR *Toxicological Profile for Lead* (ATSDR 1990). The most sensitive endpoints listed in the ATSDR document for lead effects in dogs were a no observed adverse effect level (NOAEL) of 1.25 mg/kg/day for heme synthesis and a lowest observed adverse effect level (LOAEL) of 2.5 mg/kg/day for inhibition of ALAD activity. The citation for the ATSDR endpoints was Azar et al. (1973) which was a two-year chronic study of lead acetate administered in the diet. For comparison with the mortality/paralysis results reported in Finner and Calvery (1939), the two-year dietary study (Azar et al. 1973), showed no significant effects on appearance, behavior, weight gain, mortality, or neurology even at doses as high as 12.5 mg/kg/day over the two-year study period. The toxicity endpoints presented in ATSDR (1990) agree with a study contemporary to Finner and Calvery (1939) and also cited in Zook (1973). This study showed no signs of toxicity in dogs dosed with lead at 1.0 mg/kg/day for six months (Horwitt and Cowgill 1939). Since a contemporary study (Horwitt and Cowgill 1939) and a multiple subject, controlled study of considerably longer duration (Azar et al. 1973) both disagree with the findings of Finner and Calvery's reported study results, the weight of evidence suggests that the 0.32 mg/kg/day endpoint is not a valid lower limit of effects for dogs. A more appropriate toxicity threshold would be the LOAEL of 2.5 mg/kg/day cited in the peer-reviewed ATSDR (1990) discussion of Azar et al. (1973).

2. In the *Ecological Risk Assessment*, USEPA uses a home range size of 57.5 ha, which is the smallest home range reported in the literature. ENVIRON recommended in the report submitted on November, 1992 to the Agency that the average red-fox home range should be 698 ha on the basis of procedures used by the Agency for an ecological risk assessment for Burnt Fly Bog, in which USEPA used the average of available home range values.

D. Mink Assumptions

There is strong reason to question the validity of the USEPA toxicity threshold for mink. In addition, an alternative value for the territory size of the species is suggested.

1. USEPA bases its toxicity threshold of 2 mg/kg/day on field study data for otters (Mason and MacDonald 1986). In the November, 1992 ENVIRON discussion of alternative toxicity values, the Mason and MacDonald study was reviewed and no clear correlation between lead intake (as measured by lead in feces) and adverse population effects could be established. USEPA maintains in its *Ecological Risk Assessment* (page 16) that the Mason and MacDonald study shows otter populations were reduced in areas where estimated lead intake exceeded 2 mg/kg/day.

   A reevaluation of the Mason and MacDonald study has been performed. It must be noted that the study was not designed to establish a statistical relationship between fecal lead levels and otter population success. There was no effort made to control for any site-related parameters that may contribute to poor performance of otter populations. Decreases in populations can not be reliably attributed to the effects of any one contaminant. It must further be noted that other potentially toxic metals were found in the otter feces, further confounding any attempt to attribute causation to lead exposure. Because there are no quantitative measures presented for defining population health, no dose response relationship can be made and no quantitative ranking of population health can be made. At best, the only possible comparison could be a qualitative correlation.

In a search for such a correlation the population status ("healthy" or "declining") was compared to a ranking of the mean fecal lead levels. Three populations of otters were identified in the study as being in a state of decline, Brue, Frome, and Teme. These populations ranked 1 (Brue), 10 (Frome) and 11 (Teme), out of 13 populations studied, on the basis of mean fecal lead level. There are 8 healthy, non-declining otter populations with fecal lead concentrations higher than the mean for the Frome and Teme populations. Further, the fecal lead concentration in the declining Brue population is not statistically different from the next three highest fecal lead concentrations for healthy populations. Therefore, no correlation can be demonstrated between fecal lead and otter population performance. The study authors support such a conclusion with the statement that "at the majority of localities from where faecal samples were taken, otter populations are thriving, while at three areas where otters have declined steeply and populations may be endangered (Brue, Frome, and Teme), metal concentrations in the faeces are not exceptionally high."

Because USEPA used the fecal data to calculate dietary intake of lead for the otter populations in the Mason and MacDonald study, and it is assumed that the dietary intake-to fecal lead relationship was constant for all populations, the lack of a correlation between fecal lead and population effects makes the calculation of a dietary LOAEL for this study unrealistic. The Mason and MacDonald study should not be used to establish a toxicity threshold for mink.

2. USEPA's exposure assessment for mink at the NL Site includes the consumption (50% of the diet) of an upland small mammal, the white-footed mouse. If the consumption of upland organisms is to be considered for the mink, it appears inappropriate to limit the home range estimation to the length of an aquatic habitat. ENVIRON, in the November, 1992 report submitted to the Agency, presented a list of home range data for the mink that included area determinations in addition to the stream length data used by USEPA. ENVIRON suggests the use of an average female home range expressed in terms of acres (not linear feet). This average home range value, 476 acres based on the available data, is a more reasonable estimate of home range for the NL Site.

   Additionally, no comparison has been made of the quality of the aquatic habitat available to mink in the East and West Streams versus the quality of the habitat in the Sweden surface waters on which the literature estimates of stream length territory were made. Differences in the habitat quality for mink would affect the validity of using the literature estimate. This further supports the recommendation to use an average reported territory size.

IV. Computational Errors In the Ecological Risk Assessment

The *Ecological Risk Assessment* incorrectly calculates the hazard quotient for red fox for daily intake scenario 1 for Areas I/IA and III. The hazard quotient for Area I/IA is listed as 10.06 in Table 8, where the actual ratio of daily intake to LOAEL is 6.06. The hazard quotient for Area III is listed as 14.13, where the actual ratio of daily intake to LOAEL is 8.66.

Page 10 of the *Ecological Risk Assessment* states that invertebrates comprise 43 percent of the diet of robins, with 57 percent comprised of fruits and vegetation. Table 3 in Appendix B provides an exposure calculation based upon worms being 100 percent of the diet. This inconsistency results in a hazard quotient that is roughly twice what it should be.

V. REFERENCES

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O'BRIEN & GERE

1 July 1992

Mr. Michael Gilbert
U.S. Environmental Protection Agency
Emergency and Remedial Response Division
26 Federal Plaza, Room 720
New York, New York 10278

File: 2844.014

Re: Pedricktown, New Jersey
Superfund Site

Dear Mr. Gilbert:

This letter is submitted in response to your request that NL Industries, Inc. expound upon the rationale for selecting a remedial response alternative for surface water and sediments based upon ambient water quality criteria for lead at the National Smelting of New Jersey/NL Industries, Inc. Superfund Site (the "Site") as set forth in the February 1992 Interim Feasibility Study (FS) for the Site. We are grateful that you afforded us this opportunity.

1. The Feasibility Study Recommends a Remedial Response for Stream Sediments That Will Achieve Ambient Water Quality Criteria With Minimal Adverse Environmental Impacts

To recap, the FS sets forth as remedial objectives for surface water the ambient water quality criteria for lead. We selected ambient water quality criteria as remedial response objectives because they are established benchmarks for protection of the aquatic environment, promulgated by the USEPA and also are readily measurable. The FS depicts areas where surface water quality is most adversely affected by the Site: in the West Stream south of U.S. Route 130, and in the East Stream south of the railroad tracks. Attachment 1 compares surface water quality to acute ambient water quality criteria for lead; examination of Attachment 1 shows where the acute ambient water quality criteria are exceeded. As is apparent from Attachment 1, lead concentrations in downstream segments of the West and East Streams are significantly below acute ambient water quality criteria and thus, these segments were not targeted for remediation.

O'Brien & Gere Engineers, Inc., an O'Brien & Gere Limited Company
440 Viking Dr. / Suite 250 / Virginia Beach, VA 23452 / (804) 431-2966 FAX (804) 431-9006
. . . and offices in major U.S. cities.

Surface Water Remedial Alternative B proposes remediation of sediments in all of the stream segments where acute ambient water quality criteria for lead are exceeded. These stream segments are illustrated on Attachment 2. Surface Water Remedial Alternative B would result in the cleanup of fifty-one hundred linear feet of stream sediments with a proposed depth of excavation of two feet, as illustrated on Attachment 3. These proposed portions of the East and West Streams are readily amenable to dewatering or re-direction. This makes it possible to excavate with precision in three dimensions, and to minimize the possibility of redistribution and resuspension of lead-bearing sediments. We believe that Surface Water Remedial Alternative B will achieve the dual goals of cleaning up the most lead-bearing stream sediments and minimizing the adverse impacts to the downstream aquatic biota.

We recognize that the current draft FS does not present a monitoring approach for assuring the achievement of acute and chronic ambient water quality criteria for lead. However, Surface Water Alternative B could easily be modified to include a surface water monitoring program. This program could include quarterly sampling of the East and West Streams and analysis for lead, hardness and any other necessary parameters. If the Agency recommends the addition of a surface water monitoring program to insure the continued protection of the fresh water aquatic environment, we are prepared to develop such a program for inclusion in the FS.

2. Dredging North of U.S. Route 130 Is Unwarranted and Could Have Adverse Environmental Impacts

There are stream segments downstream from the areas we have proposed for remediation that, at the present time, exceed chronic ambient water quality criteria for lead. We predict that the water quality of these downstream segments will improve as remedial work at the Site progresses for several reasons. First, removal of the upstream sediments where higher levels of lead are currently found will remove some of the source of the downstream exceedances of chronic ambient water quality criteria. Moreover, as work progresses on the Operable Unit 2 surface cleanup of the Site, such as the removal of lead-bearing slag and waste piles and pooled surface water, other sources now contributing to the presence of lead downstream will be eliminated. These remedial efforts should contribute to the improvement of downstream surface water quality, with the objective of meeting AWQC acute and chronic in these stream segments and with minimal impact on downstream biota during remediation.

We believe that the excavation of the stream segments north of U.S. Route 130 is unwarranted and would be detrimental to the aquatic environment. These stream segments are too large to be diverted or dewatered and thus, remediation would have to consist of dredging in a water column. Sediment resuspension and redistribution during the dredging is likely to result in downstream transport of entrained sediments. Further, dredging these stream sediments could be destructive to the existing ecosystem, increasing turbidity and adversely impacting the existing benthic flora and fauna.

3. The Single Sediment Cleanup Standard Suggested By USEPA, Reportedly Derived from a NOAA Document, Is Inappropriate for Use as a Cleanup Standard According to NOAA

We have previously discussed with you whether it is appropriate to establish a single numerical concentration standard to govern the cleanup of stream sediments at the Site. You have referred to a report published by the National Oceanographic and Atmospheric Agency entitled "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program", Long & Morgan, 1990 (hereinafter, the "NOAA report") as a possible source for the establishment of such a standard. The NOAA report refers to two levels of concentrations, the Effects Range Low (ERL) and Effects Range Medium (ERM) concentrations. We continue to believe that establishing a cleanup standard for stream sediments with reliance on either of these numbers is inadvisable, and without scientific basis, for several reasons.

The FS states that no toxicity-based criteria or standards are available for cleaning up lead in stream sediments. We reached this conclusion after careful evaluation of the scientific literature and, in particular, an examination of the NOAA report to which you referred. In fact, the NOAA report plainly states: "[t]hese guidelines were not intended for use in regulatory decisions or any other similar applications." NOAA report at p.1.

Because we understood this issue to be one of interest to you, we consulted directly with one of the authors of the NOAA report. Edward R. Long, co-author of the document, confirmed in a telephone conversation, that the ERLs and ERMs presented in the NOAA report were not intended to be used as standards or criteria for the cleanup of sediments. Mr. Long stated that the caveats against such use set forth in the NOAA report continue to apply.

Because we knew that you wanted to encourage further discussion on this issue, we asked Dr. James Rhea of O'Brien & Gere, who has expertise in the area of sediment chemistry, to comment on the extrapolation of cleanup standards from the NOAA report. Dr. Rhea concludes that such use of the ERL and ERM values presented in the NOAA report is inappropriate for several reasons:

i. the ERM and ERL values fail to take into account the differences in bioavailability of contaminants in different sediments with widely divergent chemical and physical characteristics;

ii. the ERM and ERL values do not identify any cause and effect relationships between chemical and biological effect (i.e., the values assume that chemicals quantified in studies are responsible for observed biological effects); and

iii. the article relies heavily on data that lacks independent validation.

Dr. Rhea has written a critique regarding the employment of ERL and ERM values as cleanup criteria for lead at this Site, attached hereto as Attachment 4.

Some of Dr. Rhea's comments are echoed by Mr. Long in a recent publication entitled "Ranges in Chemical Concentrations in Sediments Associated with Adverse Biological Effects", Marine Pollution Bulletin, Vol. 24, No. 1, 1992. Therein, he summarizes the deviations in the NOAA ERLs and ERMs stating:

> The ranges in concentrations may represent fortuitous flukes, since the variables that control bioavailability of sediment toxicants were not accounted for and differences in analytical methods, biological tests, sediment regimes, etc., occurred among the studies. . . In addition, data derived in fresh water, estuarine, and marine studies were treated equally, despite the possibility that bioavailability may differ remarkably between the two regimes.

Marine Pollution Bulletin, Vol. 24 at p. 43.

Mr. Long concluded that the evaluation of a hodgepodge of data in the NOAA report, collected from different approaches, laboratories and techniques, was analogous to comparing "grapes and watermelons". He viewed this type of comparison as "symptomatic of the current status of knowledge regarding the degree of sediment contamination that is associated with measures of biological effects" and advocated the development of techniques beyond those that are currently available.

4. If the Agency Still Has Reservations About Surface Water Remedial Alternative B, We Recommend the Performance of a Benthic Study and the Consideration of Factors Affecting Bioavailability

Because of the drawbacks of dredging stream segments, any decision to expand the proposed remediation of stream sediments should be based upon consideration of whether the benthic community has been adversely affected by the Site. A suitable study would compare community parameters such as species diversity, taxa dominance, species abundance, and spatial distribution in a control area unaffected by the Site to similar parameters in the potentially impacted stream sediments. Remedial decisions could then be based on statistically supported differences, if any, in the benthic community parameters. The benefit of such a study is that the adverse impacts of dredging would not be risked without prior demonstration of an adverse impact of the discharges from the Site upon the receptor ecosystem.

We also recommend the collection and analysis of data to allow the evaluation of bioavailability of lead in the stream sediments. Such data to be collected would include sediment type and properties, including organic matter content and acid volatile sulfide concentration, pH, salinity, and oxidation-reduction potential.

5. Conclusion

As you discussed with Stephen Holt, we look forward to meeting with the Agency personnel to discuss this matter further. We envision a technical discussion with input from NL's ecotoxicologist, as well as other engineers and scientists. Please call Mr. Holt at (609) 443-2405 at your earliest convenience to discuss dates for this meeting.

Very Truly Yours,

O'BRIEN & GERE ENGINEERS, INC.

Daniel G Callen for

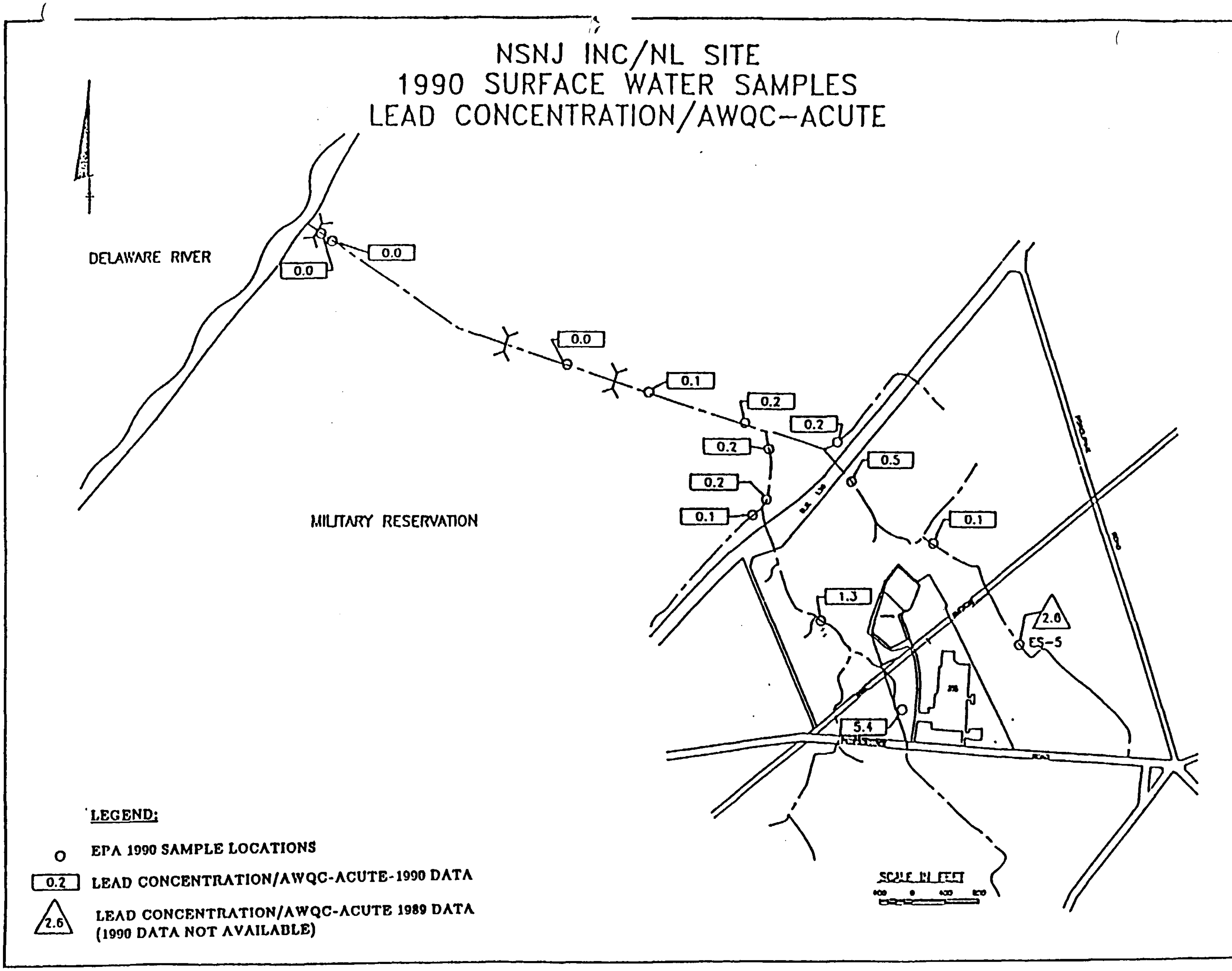
James M. O'Loughlin, P.E.
Senior Project Engineer

JMO:SWH:bg
Attachment

Mr. Michael Gilbert, USEPA, Original + 5 copies
Mr. Paul Harvey, NJDEPE, 6 copies
Mr. Stephen W. Holt, 1 copy

bcc: R. Machado
R. Oslan
J. Rhea
J. Schlesinger
J. Smith, Esq.
C. Pal, Esq.

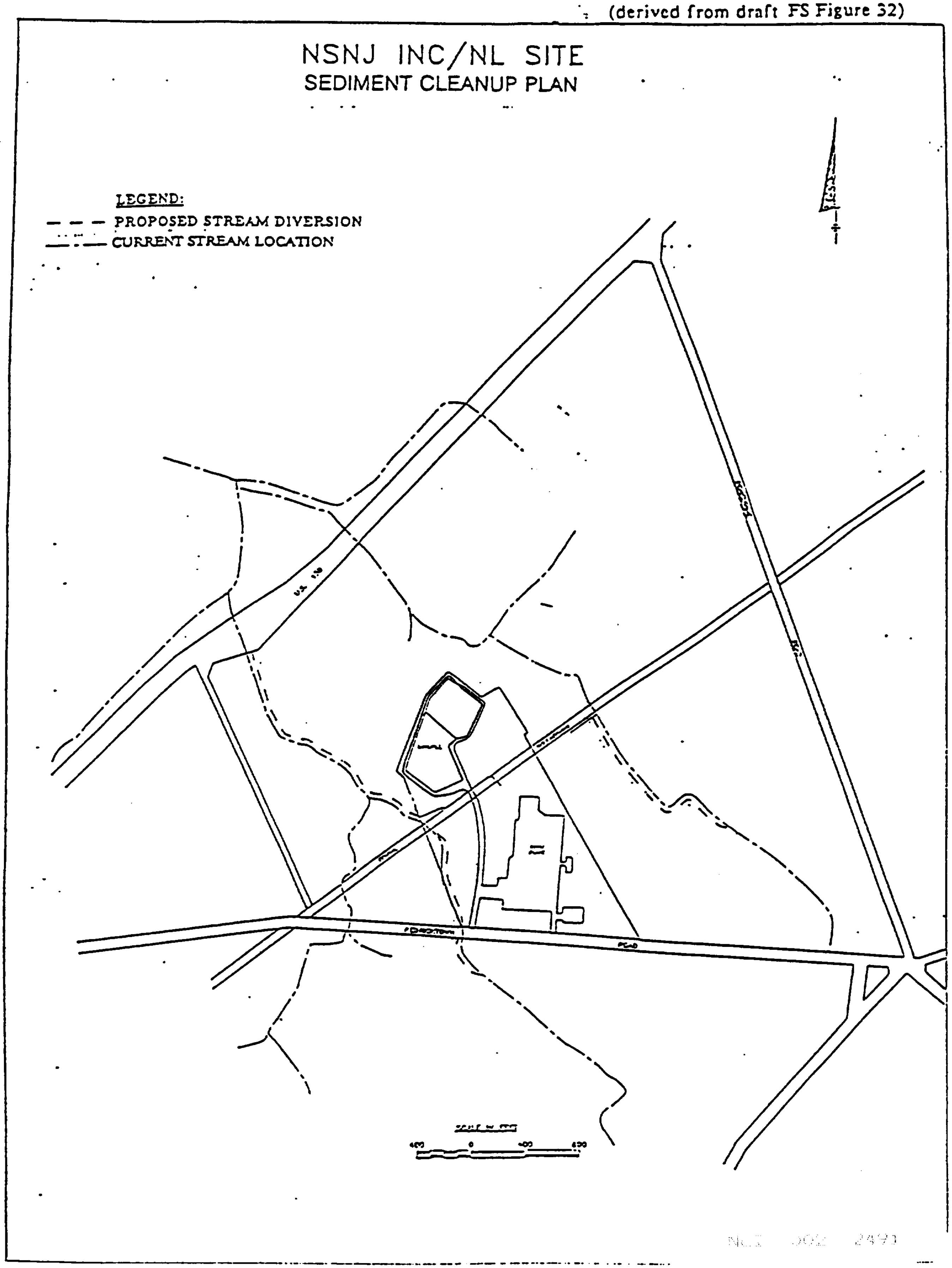
O'BRIEN & GERE



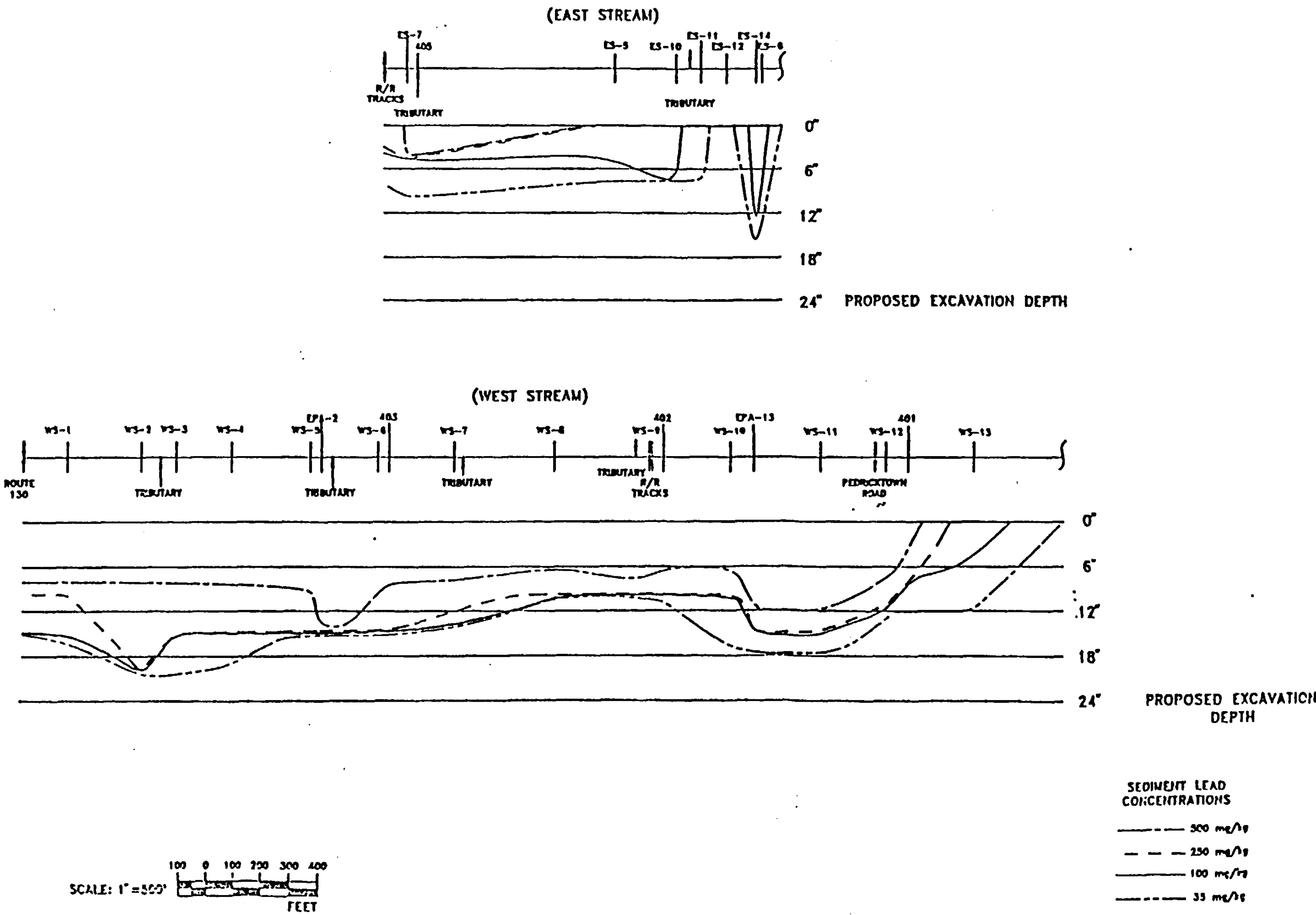
ATTACHMENT I
(derived from draft FS Figure 19)

ATTACHMENT 2

(derived from draft FS Figure 32)



NSNJ INC/NL SITE
VERTICAL EXTENT OF LEAD IN STREAM SEDIMENT



ATTACHMENT 3
(draft FS Figure 22)

NLI0022492

O'BRIEN & GERE

Memorandum

Attachment 4

To: Jim O'Loughlin

From: Jim Rhea TRB

Subject: Pedricktown Site

Date: 1 July 1992

File: 2844.014

Copies: K. Farmer
E. Michalenko

NL INDUSTRIES INC.
PEDRICKTOWN, NEW JERSEY

CRITICAL REVIEW OF THE APPLICATION OF NOAA EFFECTS RANGE VALUES TO ESTABLISH LEAD CLEAN-UP LEVELS IN AQUATIC SEDIMENTS

BACKGROUND

The National Oceanic and Atmospheric Administration (NOAA) annually samples and chemically analyzes marine and estuarine sediments from approximately 200 sites throughout the United States. This sampling and analysis effort is conducted as part of the National Status and Trends (NS&T) program and includes the analysis of sediments for trace metals, petroleum hydrocarbons, and synthetic organic compounds. The principal objective of the NS&T program is to characterize the chemical conditions at the sites and to establish temporal trends in pollutant levels[1,2]. The effects of chemical concentrations on the native biological community has not been measured at the majority of the sites in the NS&T program.

In an attempt to prioritize the sites within the NS&T program for intensive regional surveys, NOAA developed guidelines for evaluating the potential for chemically induced biological effects of contaminated sediments[3]. The overall approach consisted of:

- assembling and reviewing the technical literature for information in which adverse biological effects of sediment contaminants were calculated, measured, or could be derived,

[1] National Oceanic and Atmospheric Administration. 1987. National Status & Trends Program for marine environmental quality. Progress report and preliminary assessment of findings of the benthic surveillance project-1984. Rockville, MD. Office of Oceanography and Marine Assessment.

[2] National Oceanic and Atmospheric Administration. 1988. Progress Report. A summary of selected data on chemical contamination in sediments collected during 1984, 1985, 1986, and 1987. NOAH Technical Memorandum NOS OMA 44. Rockville, MD

[3] National Oceanic and Atmospheric Administration. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. Technical Memorandum NOS OMA 52. Office of Ocean and Marine Assessment. Rockville, MD.

- determine ranges of concentrations in which biological effects were likely to occur, and

- evaluate chemical data from the NS&T program sites with respect to established concentrations ranges estimated to produce biological effects.

The technical literature reviewed included reports which documented controlled laboratory studies of biological effects of sediments containing individual compounds, calculations of sediment quality criteria based upon equilibrium partitioning concepts, and field studies in which simultaneous measurements of chemical concentration and biological effects were measured.

Specific chemical concentrations observed or predicted to pose an adverse biological effect were sorted and an apparent effects threshold, lower 10 percentile concentration, and median concentrations were identified for a number of chemicals. The lower 10 percentile concentrations were identified as the Effects Range-Low (ER-L) values and the median concentration in the sorted list were identified as the Effects Range-Median (ER-M) values.

NOAA explicitly states that the ER-L and ER-M were not intended to be used as NOAA standards or criteria, but were simply developed as a means of assessing the NS&T data.

A number of different approaches for establishing effects based sediment quality values were employed for the analytes in the NS&T program. These different approaches included:

- background approach (BA),
- sediment/water equilibrium partitioning approach (EP),
- spiked sediment bioassay approach (SSB),
- screening level concentration approach (SLC),
- apparent effects threshold approach (AET), and
- bioeffects/contaminant co-occurrence analyses approach (COA).

The approach employed by NOAA in establishing ER-L and ER-M values assumes that data from several sediment quality criteria approaches would establish patterns between chemical concentrations and biological effects and would, therefore, be a more robust measurement of biological effects than numbers derived from a single approach.

<u>ER-L AND ER-M FOR LEAD</u>

An ER-L and ER-M for lead were established from 47 observed or calculated biological effects values from a number of sites. These values were established from the following approaches:

APPROACH	NO. OF APPLICATIONS	PERCENT OF TOTAL
AET	7	14
EP	2	5
COA	38	81
TOTAL	47	100

The technical merit of the NOAA technique for establishing the ER-L and ER-M values lies in the integration of multiple approaches to establish biological effects-based sediment chemical concentration values. However, the technical literature for lead is limited to three approaches: AET, EP, and COA. Of these, the COA approach accounts for 81 percent of the database. Therefore, the ER-L and ER-M values derived for lead are biased toward values predicted from the COA approach. The COA approach includes a number of inherent assumptions regarding co-measurement of biological effects and chemical concentrations which limits its application in chemically complex environmental settings. Finally, the database for lead does not contain a single reference for an SSB derived biological effects level. An SSB value could be used to verify values obtained by other approaches.

COA APPROACH

The bioeffects/contaminant co-occurrence analysis or COA approach involves the application of field collected data for both chemical concentration and observed biological effects. The approach includes the calculation of the centrality of the chemical data (e.g. means, medians, etc.) with associated biological effects observations (high, intermediate, and low indications of effects). It is significant to note that, the data used to calculate the COA effects values ultimately employed to establish ER-L and ER-M values were collected for purposes other than determining effects thresholds.

The principal concerns with the COA approach of establishing sediment quality criteria are:

- its inability to describe cause and effect relationships,
- its lack of independent validation, and
- its inability to describe differences in bioavailability of chemicals in different sediments.

The first concern regarding the COA approach originates from the inherent assumption that the chemicals quantified in the studies include those responsible for the observed biological effects. Chemicals not included in the analytical program for a given site may have been acting singly or synergistically with other chemicals to induce the observed effect.

The second concern is important because the COA approach assumes that the effects of the chemical compounds in question have an adverse effect in excess of that caused by the natural ecological stress inducing factors at the site. An independent validation of the COA observations such as an SSB conducted with suitable controls is desirable to filter out the effects of natural physicochemical stresses at the site.

The third concern is important because of the heterogeneity of aquatic sediment systems and the variability in factors controlling bioavailability and consequently biological effects. The bioavailability of chemicals in sediments are controlled by a number of factors including: sediment organic matter content, redox potential, pH, and in the case of trace metals, the presence of precipitant such as carbonate and sulfides. Sulfide concentrations are particularly important in controlling the bioavailability of trace metals in anoxic environments.[4]

SUMMARY

The ER-L and ER-M values were developed by NOAA solely for the purpose of assessing the NS&T data. NOAA explicitly states that these values should not be applied as sediment cleanup or quality criteria. Furthermore, the ER-L and ER-M values derived for lead are based primarily on the COA approach for establishing biological induced effects of chemicals. This approach has a number of technical limitations with regards to establishing cleanup level for sediments.

The ER-L and ER-M values derived from the NOAA database should not used as a basis for establishing sediment cleanup goals at the Pedricktown, New Jersey site.

[4] DiToro, D.M., and others. 1990. Toxicity of cadmium sediments: the role of Acid Volatile sulfide environmental toxicology and chemistry 9:1487-1502.

THOMPSON ASSOCIATES
U. S. Route 130, Box 156 A
Pedricktown, N.J. 08067

September 16, 1993

Mr. Stephen W. Holt
CORPORATE ENVIRONMENTAL SERVICES
NL INDUSTRIES, INC.
P.O. Box 1090
Wykoffs Mill Road
Hightstown, N.J. 088520

Re: Access for NL Pipeline to Delaware River

Dear Mr. Holt:

This letter will confirm our discussion regarding your request for authorization for a pipeline easement on our property. We understand that the Pedricktown Site Group ("PSG"), a group of companies identified by the U.S.E.P.A. as potentially responsible parties for the Pedricktown Site, is seeking to acquire the necessary easements to allow PSG to construct and operate a water discharge pipeline between the former NL Industries, Inc. Site in Pedricktown, N.J. and the Delaware River. The pipeline is planned to be constructed as part of the remediation activities directed by the U.S.E.P.A. at the NL Industries Superfund Site. We understand that an easement for this pipeline requires the consent and cooperation of Thompson Associates, since our property lies between the former NL Site and the Delaware River.

We acknowledge that you have discussed the proposed pipeline easement with us and have given us preliminary information including a site sketch showing the proposed path. Based upon this preliminary information, we have no objection to entering into negotiation for the granting of such an easement.

Sincerely yours,
THOMPSON ASSOCIATES
Harry A. Skilton
Partner

HAS:hpc
cc:Mike Testa, BASILE, TESTA & TESTA
file

NLI 002 2497

THE GEON COMPANY

P.O. Box 400
Rte. 130 & Porcupine Rd.
Pedricktown, New Jersey 08067
609-299-5400

Mr. Stephen W. Holt
Corporate Environmental Services
NL Industries, Inc.
P.O. Box 1090
Wykoffs Mill Road
Hightstown, New Jersey 08520

Re: Easement for Treated Effluent Pipeline To the Delaware River

Dear Mr. Holt:

This letter is to confirm the discussions you had with our Mr. Jim Kiel, Manager of Environmental Affairs, for The Geon Company Pedricktown Facility on September 9, 1993 regarding your request for an easement for a treated effluent pipeline on property owned by The Geon Company. As per the Superfund Proposed Plan for NL Industries, Inc. Operable Unit One Pedricktown, Salem County, New Jersey dated July 1993, it is anticipated that the Pedricktown Site Group (PSG), a group of companies identified by the U.S.EPA as potentially responsible parties for the NL Industries Inc. Pedricktown site, will seek to acquire the necessary easements to allow the PSG to construct and operate a treated effluent discharge pipeline from the former NL Industries, Inc. Site, Pedricktown, New Jersey to the Delaware River. This pipeline would be constructed as part of the remediation activities directed by the U.S.EPA at the NL Industries Superfund Site. The Geon Company recognize that such a pipeline would require the consent and cooperation of any property owner between the NL Site and the Delaware River plus all the appropriate environmental and construction permits.

The proposed pipeline easement path is tentatively adjacent to The Geon Company property Block #39 Lot #19 and through Block 39 Lot #16 as per the attached NSNJ INC/NL SITE drawing. Based on this preliminary information and subject to a mutually acceptable agreement between the involved parties, The Geon Company hereby expresses its intent to actively discuss with the intent to grant such an easement to PSG.

Please contact Mr. Jim Kiel to initiate formal discussions regarding the proposed pipeline easement.

Sincerely,

William Fultz

William Fultz
Pedricktown Plant Manager
The Geon Company

cc. Jim Kiel
    Jim Lewis

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